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THE NEW TAY VIADUCT.

This viaduct is designed to replace the metallic bridge over the same river, that was blown down in December, 1879, by a storm of extreme violence, carrying down with it a train which was crossing. The new work (see Fig. 4) is 10,800 feet in length. It comprises two approaches, the southern one, A, of which is horizontal and formed of 27 spans, while the northern one, B, consists of 45 spans, and has a falling gradient of 1 to 114. Between the viaducts there is a bridge, B, of 13 spans of 230 feet each, four of which allow a clear headway for shipping of 77 feet. The viaduct spans are naturally shorter than those of the bridge, and vary from 50 to 166 feet. At the south end the work connects with the shore by four brick arches of 50 foot span, the first of which forms an abutment. These arches support the junction of the tracks of the Newport branch with those of the Edinburgh main line, and they progressively diminish in width until they unite with the metallic part. At the north end the work crosses the extension of the Dundee esplanade, and for this reason an abutment could not be constructed; so two wrought iron skew arches supported by brickwork masonry have been substituted therefor. Beyond these are four spans of wrought iron girders supported by cast iron columns standing upon granite bases. All the other piers, 77 in number, that support the structure are of the same type—consisting of two cylindrical wrought iron caissons for the bridge and southern viaduct, and cast iron ones for the northern. These are internally lined with brickwork and filled in with concrete, which, in the first ones, reaches the level of low water, and in the second extends to the very top. The diameter of the bases of these caissons varies from ten to twenty-three feet, according to the length of the span. Each caisson is constructed of three cylinders, that diminish in diameter from base to apex. Except in a few cases where they are founded upon rock, the cylinders are sunk to depths varying from 20 to 30 feet below the bed of the river, so as to preserve them against the scouring action of the tide. Before going further with the foundations, they are tested by loading them with a weight which is 33 per cent greater than that of the two trains that they are calculated to support. The upper parts of the caissons of each pier are afterward connected at 1½ feet above high water by cast iron girders 8 feet in height, the interval being filled in, as in the caissons with brickwork and concrete. On top of the cylinders rise octagonal shafts connected by a semicircular arch upon which rest the principal girders. These latter are four in number upon the viaducts, properly so-called, and are cross-braced with diagonal stays, while on the bridge there are but two, which are much stronger, and are cross-braced above with secondary girders. The sections in Fig. 3 show these arrangements.

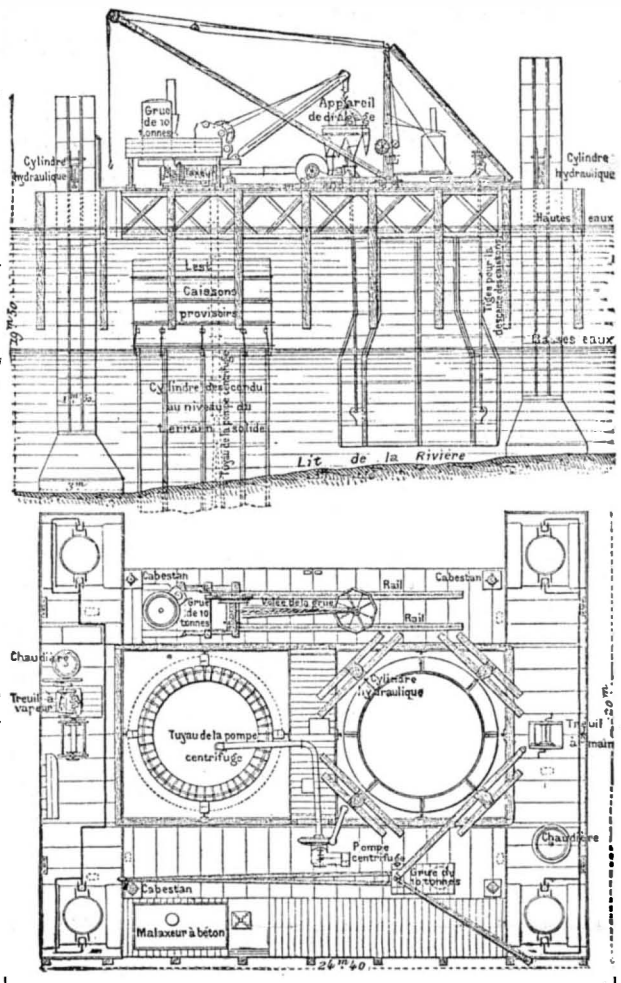

Fig. 1.—ELEVATION AND PLAN, SHOWING CAISSONS SUPPORTING COLUMNS AND MOVABLE PLATFORM.

The construction and sinking of the caissons is effected by means of an entirely new apparatus, whose arrangements are due to the Messrs. Arrol, the contractors for the work, who likewise have in charge the construction of the gigantic bridge over the Firth of Forth. The apparatus consists of a metallic platform composed of two main caissons of iron plate and a third one parallel with them. The three are connected by girders, which support a stage upon which are placed the pumps, hydraulic engine, material, etc. At each of the four corners of this pontoon thus formed is arranged a vertical wrought iron tubular leg, 5 feet in diameter and 64 in length. These cylinders are open below, and provided with a transverse partition 2½ feet above the cutting edge, in order to prevent them from entering the bed of the river to too great a depth. In the platform there are two large rectangular openings in which the cylindrical caissons, C, of the piers are constructed and submerged. In order to perform these operations at any height of the sea, it is necessary that the platform shall be capable of rising and falling *in situ*. To this effect, each of the four columns is provided with two double vertical guide bars, B, (Fig. 5), of steel, which are diametrically opposite, 15 inches apart, and contain apertures 6 inches apart. Between these two bars move two plates, D D, which are connected with

(*Continued on page* 20.)

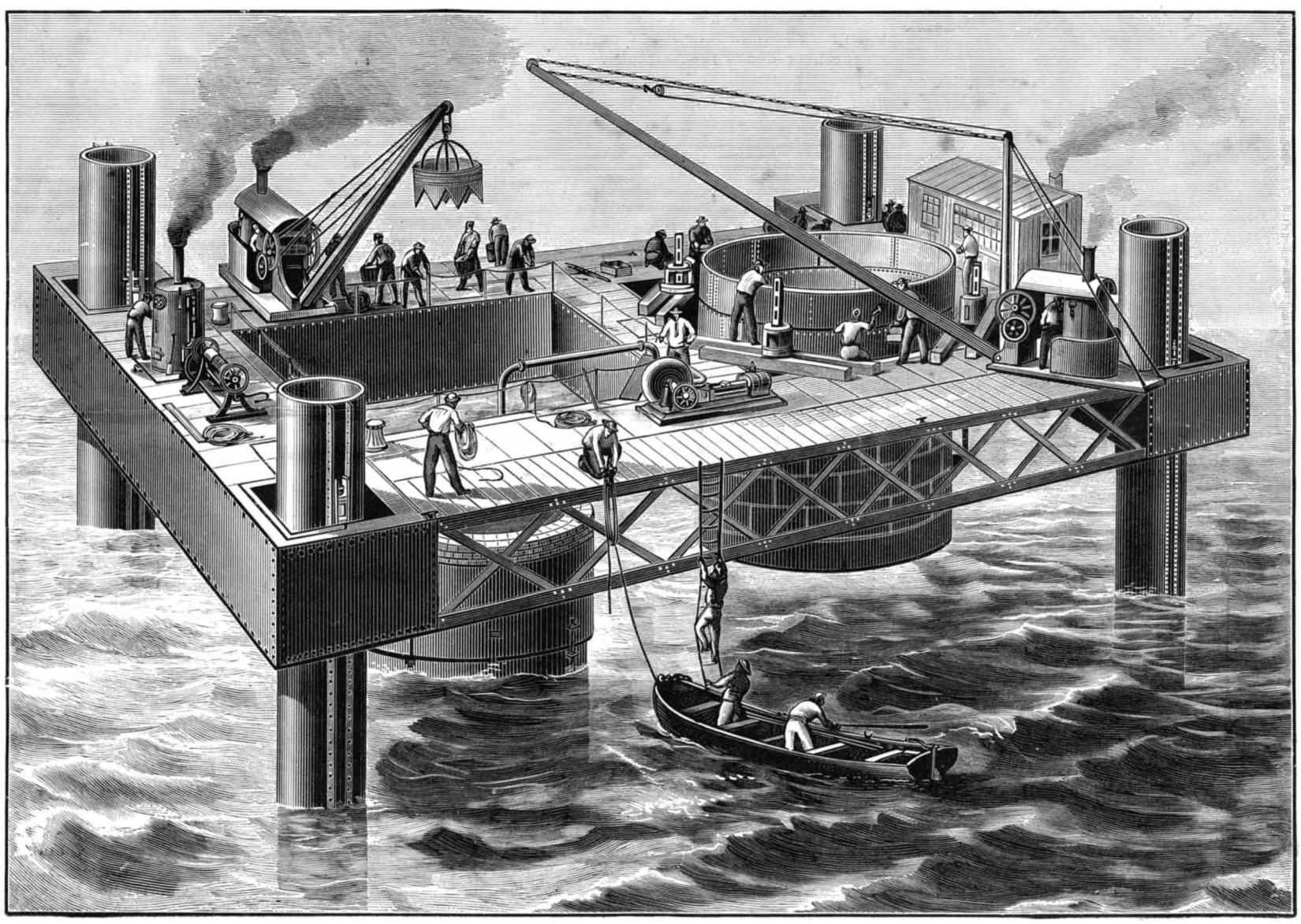

Fig. 2.—CONSTRUCTION OF PIERS OF THE NEW TAY VIADUCT.

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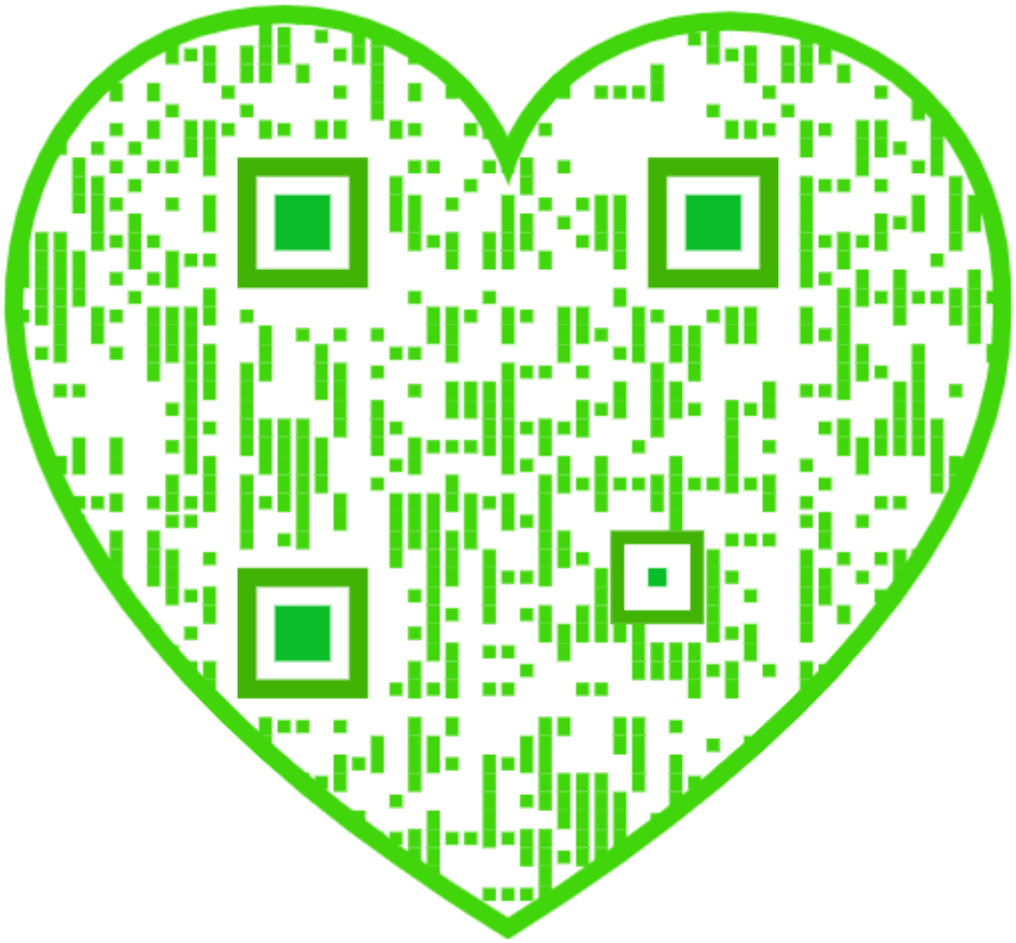

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ELECTRIC LIGHT ON CAPTIVE BALLOONS.

The trials recently made in England of electrical signalizing from captive balloons show that an important service may be rendered by this means, both in peace and war. Of course, it does not require the use of the electric light to signal from captive balloons, for such service has been had in recent wars by the aid of flags by day and colored lights by night. But balloons for this service must be large and cumbersome for carriage in an army train, and have sufficient buoyancy to sustain the weight of a man in mid-air with safety, whereas by the use of electricity the same service can be performed by a small and inexpensive balloon, and one that can be readily transported. The incandescent electric light is peculiarly adapted for this work. It can soon be made as powerful as the arc light, and can be fed by a wire, say of silicious bronze, so fine as to be lost from sight in the line holding the balloon, even though that line be an ordinary cod-line; and the wire is so light that a single man can carry several miles of it.

It requires, as we know, only two characters or visible movements to send the longest message. In telegraphy the dot and the dash or the short and long sound and their combinations are used. In the army wig-wag system, a flag moved to right and left during the day, and a white light moved over a stationary red one at night, are readily made to answer the same purpose. From this it will be seen that a flash light, that is to say, one which can be made to glow or disappear at pleasure, may be made to furnish the required number of movements. Thus the electric light, which may be controlled as rapidly as a telegraphic sounder makes and breaks the circuit, can be used as the medium of transmitting information.

The trained armies of to-day lay a military telegraph along the line of their communications as they march, and usually separate ones to various points of their advanced picket-line, but often they have no other means of communicating with supporting columns coming from various directions, or main lines, save that afforded by the uncertain courier. At established headquarters balloons are often used, but in marching columns they are too cumbersome, and require too much time to prepare for operation. The electric balloon, on the other hand, can be carried by one man without inconvenience, and all its apparatus stowed away in a corner of one of the caissons of the artillery train. Such a light as one of these balloons could support might be seen for a great many miles on a clear night; and by means of a constant variation of the signal code, the enemy kept in ignorance of the contents of the dispatches. These balloons might also prove of great value as an auxiliary to the Weather Bureau. In the vicinity of harbors the very earliest intelligence as to advancing storms might thus be conveyed to the masters of ships who have already cleared and are making their way seaward. The present arrangement of setting storm signals upon high buildings or staffs overlooking harbors is an excellent one as far as it goes, but it cannot always be seen far enough and every time it is set in a great port like New York or Boston or Baltimore, sailing vessels are already beyond its range of visibility in the open sea. Such a signal as could be furnished from a captive balloon could be seen far out on the coast; and should that signal warn them that a storm was approaching from the very direction in which they were bound, it would enable them to make a harbor or get under a lee where they could ride it out in safety.

Mechanical Substitute for a Horse.

Chambers's Journal mentions a gentleman who, being prevented, by physical disqualification, from continuing the exercise on horseback which had always been so beneficial to his health, was possessed with the singular notion that it would be possible to construct a machine which, when seated upon, could be made to evolve the same action as a galloping horse. The inventor made his machine; it answered its purpose to his complete satisfaction; and the device having been patented, it has recently been manufactured and brought before the public. Whimsical as is the purpose of the machine, it has, upon trial, been commended by many medical authorities, and won no little favor.

The "rider" seats himself upon an ordinary leather saddle, his feet being in fixed stirrups, and his hands grasping a handle attached to a metal projection. The saddle is firmly attached to a small wooden platform below by means of metal connections. This platform is suspended by leather straps from the topmost extremities of four semicircular steel springs, which are firmly attached at the bottom to the metal foundation of the machine. Seated upon the saddle, the operator can be swayed about in all directions.

Beneath the platform are four padded buffers—corresponding to the horse's feet—and by the weight and motion of the operator's body these buffers strike or bump, at each depression, upon the foundation below, so that, with a little practice, an automatic imitation of horse exercise can be produced. The movement can be made either very easy or very violent. By the full use of the handle, a good muscular action is given to the chest and lungs. For invalids and all of a weak bodily constitution, the machine is strongly recommended. It is adjustable for the use of persons of different stature and weight; and for those condemned to sedentary employment, its daily use is said to be attended with beneficial results.

Cheap Sodium.

The manufacture of cheap sodium by an electrolytic process has been announced in France. An engineer of Lyons, M. Lossier, states that he will soon be in a position to sell sodium in large quantities at a price of about 25 centimes per kilo, not much over one penny a pound. There would be no necessity for such an extremely low figure to be reached to insure a very large demand for the material. The process of M. Lossier consists, it appears, in decomposing, with an electric current, the chloride of sodium at a temperature of 900 deg. C., and it appears incredible that by any such process the price named is not absurdly low. In France, indeed, sea salt, which costs about 2½ centimes the kilo to obtain, is sold wholesale at 10 centimes the kilo, the duty being considerable.

It appears that 3 kilos of salt are required to produce 1 kilo of chloride of sodium. It follows that, at current prices, the sodium not extracted from the combination is worth 30 centimes the kilo, to which must be added the cost of fuel for melting and heating the salt, the expense of producing the current, general expenses, profits, interest, and depreciation, which would be extremely high. The price of 25 centimes appears therefore to be far too low, even if the salt be valued at the prime cost of production. It may be remarked that marine salt is at once one of the cheapest and most abundant materials known in commerce. *Engineering* says that if we assume a moderate area and depth of that portion of the globe covered by the ocean, the quantity of salt that it contains is estimated at six times the volume of the Alps. Unlike coal, the supply of which is being gradually but surely exhausted, marine salt is absolutely inexhaustible. It is therefore essentially a raw material of high value, for which many applications have yet to be discovered.

Uses of Sulphuric Acid.

Some of M. Pasteur's latest experiments have proved that water containing two per cent of concentrated sulphuric acid possesses the property of destroying bacteria, and this mixture of acid and water is recommended for disinfecting efficaciously the floors of stables, mangers, cattle stalls, courtyards, areas of dwellings, dust bins, etc. Sulphuric acid, properly diluted, is a valuable cooling and astringent remedy. It is used to acidify certain decoctions or infusions. Only the dilute acid (in most countries, one part pure acid, nine parts water) is ever used medicinally. Ten to twenty-four drops of this dilute pharmaceutical acid will give an agreeable acidity to one quart of the infusion or other liquid. As many fever patients are fed principally on milk, care must be taken never to give liquids containing sulphuric acid or acid lemonades of any kind too soon after milk has been given, otherwise it may produce unpleasant symptoms of indigestion. In France, an alcoholized sulphuric acid is sometimes used. It is made by adding concentrated sulphuric acid, 100 parts, to alcohol (of 85 per cent), 300 parts, and is generally colored red by the addition of 4 parts of the petals of the red poppy. Sulphuric lemonade is made from this according to the formula:

	Parts.
Alcoholized sulphuric acid	3
Simple sirup	60
Water	1,000

This is also known as "mineral lemonade."—*Chemist and Druggist.*

A Dead Black Paint.

The Locomotive, issued monthly by the Hartford Steam Boiler and Inspection Company, gives the following receipt for painting brass tubes, and such articles as optical instrument makers produce, a "dead black." The writer says he has found all the formulæ and recipes given in the books unsatisfactory because of their vagueness, but that the following can be relied upon to give a first-rate dead black, and it is easily made:

Take two grains of lampblack, put it into any smooth, shallow dish, such as a saucer or small butter plate, add a little gold size, and thoroughly mix the two together. Just enough gold size should be used to hold the lampblack together. About three drops of such size as may be had by dipping the point of a lead pencil about half an inch into the gold size will be found right for the above quantity of lampblack; it should be added a drop at a time, however. After the lampblack and size are thoroughly mixed and worked, add twenty-four drops of turpentine, and again mix and work. It is then ready for use. Apply it thin with a camel's hair brush; and when it is thoroughly dry, the articles will have as fine a dead black as they did when they came from the optician's hands.

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PHOTOGRAPHIC NOTES.

Novel Detective Cameras.—At a recent meeting of the Society of Amateur Photographers in this city, two novel cameras were shown. One, called a vest camera, the invention of Mr. R. D. Gray, consisted of a circular case of metal nicely nickel plated, about seven inches in diameter and two inches thick, divided by a thin blackened metal partition on the inside, having a small truncated aperture cut between the center and its outer edge. Upon the front side of the partition, held in close contact with it by a small pressure spring, was a rotating shutter propelled by a flat coiled steel spring, and provided with four apertures similar in size and shape to that in the partition.

A shaft or spindle passed through the center of the partition, to which the spring of the shutter was attached, and around which the shutter loosely revolved. The end of the spindle passing to the rear of the partition terminated in a disk two inches in diameter, upon which the sensitive plate, cut in the shape of an octagon, rested. A pawl and ratchet wheel just under the disk prevented the spindle from rotating backward, and at the same time served to hold the spring of the shutter to any desired tension.

The front face of the case, carrying a small lens made to imitate a good sized button, slipped over the rim, and was attached thereto by a bayonet joint; through the center projected the front end of the spindle, on the end of which was screwed a small black button, having a slight brass projection at its edge, intended to serve as a guide when rotating the plate, that the operator may know where his first exposure was located.

A simple spring release device for the shutter was arranged on the inside rim of the case, operated by pulling a string which passed to the outside and was long enough to come down under a vest to the waist of the operator.

The back of the case had on its inside, near the center, a flat spring, which, as the back was attached to the rim by a bayonet joint, pressed upon the back of the sensitive plate, holding it face down against the face of the rotating disk, previously mentioned.

A false vest, made of stiff "hatter's" material, had on its rear side a leather pocket, into which the metal case was put, and through special openings (the edges of which were covered with binding), the lens tube and spindle projected. A flat cord passing over the back of the neck suspends the vest in position; and, when the coat is buttoned near the neck, over the false vest, the lens tube appears to be like a button on the coat, and is remarkably deceptive.

To operate the camera, it is only necessary, when opposite and within the proper distance of the object, to pull the string, hanging slightly below the bottom of the vest, which releases the shutter, and makes the exposure, without attracting the attention of any one. The small knob on the front end of the spindle is then rotated to the right until a click is heard inside, which indicates that the sensitive plate has been revolved forward sufficient to receive a new impression, at the same time the coiled spring is wound up equivalent to the amount it was uncoiled when operating the shutter, so that the speed of the latter, though moving continually forward in one direction, will be uniform.

Each plate will receive eight impressions, and when full may be replaced by a fresh plate in the usual dark room. All the images have to be developed together in one solution; and as the exposures have been uniform, the pictures usually develop out equally. The exposure may be made very rapidly, as it is not necessary to operate any plate holder.

We have seen several negatives, and enlargements from the same, made by the apparatus, which were so well done that they fully demonstrated its practicability, and proved it to be a truly detective camera. We should mention that by unscrewing the lens button a certain number of turns, the focus is regulated to suit different distances. Another advantage is that pictures can be secured while in the act of walking, leaving the hands perfectly free.

The other camera referred to was in the shape of a large opera or field glass, shown by Mr. C. Volney King, and arranged for him by Mr. Wm. T. Gregg, of this city. On the small end of one tube was the lens, behind it the shutter, a rotating disk actuated by a coiled flat steel spring, and released by a small trigger, while at the large end was fitted a case to hold the small sensitive plate. The circle of the picture is 2⅛ inches in diameter. In the other tube was a similar lens, but at the large end was a ground glass. The operator, after drawing out the slide of the miniature plate holder, had, in order to take the picture, only to reverse the opera glass, look at the object through the large end, and focus by working the usual central screw with the thumb and middle finger then, when all was ready, press the releasing trigger with the little finger, which made the exposure. When the image was sharp on the ground glass, it would also be on the sensitive plate, as both were in the same plane. It was only necessary to put in a fresh plate to take successive pictures, and these being small were easily carried about in the pocket. The pictures could be enlarged without difficulty, and were the correct size for the magic lantern. Being small, compact, light, and portable, and in the form of an article in common use, the camera possessed many advantages not found in ordinary so-called detective cameras.

To Prevent the Curling of Gelatine Paper Prints.—After the print has been fixed and washed, it is immersed for a few minutes in a five per cent solution of glycerine and water, then removed, and directly squeegeed on a sheet of smooth hard rubber, then left to dry. When pulled off, it will lie as flat as a sheet of glass.

Possibilities of Vessels Communicating with Each Other at Sea.

The number of directions in which experiments are being made with electricity is almost numberless. Prof. Bell, in a recent interview, stated that similar conclusions had been reached by himself and Prof. Trowbridge as to a means of vessels communicating with each other at sea, as follows:

"Most of the passenger steamships have dynamo engines, and are electrically lighted. Suppose, for instance, one of them should trail a wire a mile long, or any length, which is connected with the dynamo engine and electrically charged. The wire would practically have a ground connection by trailing in the water, at least, the result would be the same. Suppose you attach a telephone to the end on board of a ship. Then your dynamo or telephone end would be positive, and the other end of the wire trailing behind would be negative. All of the water about the ship will be positive within a circle whose radius is one-half of the length of the wire. All of the water about the trailing end of the wire will be negative within a circle whose radius is the other half of the wire. If your wire is one mile long, there is then a large area of water about the ship which is affected either positively or negatively by the dynamo engine and the electrically charged wire. It will be impossible for any ship or object to approach within the water so charged in relation to your ship, without the telephone telling the whole story to the listening ear. Now, if a ship coming in this area also has a similar apparatus, the two vessels can communicate with each other by their telephones. If they are enveloped in a fog, they can keep out of each other's way. The ship having the telephone can detect other ships in its track, and keep out of the way in a fog or storm. The matter is so simple that I hope our ocean steamships will experiment with it. The principle is not new; it is old, with a new use waiting for commerce to utilize it. I have experimented on the Potomac, and marveled at the simplicity of the apparatus and the stupendous importance of the results."

Fire Dangers from Steam Pipes and Hot Air Flues.

In the course of a recent lecture by Dr. Tanner before the Louisville Board of Underwriters, the subject of fires caused by steam pipes and hot air flues was discussed at considerable length. In the course of his address, Dr. Tanner spoke as follows:

Mr. James Braidwood, who was for many years chief of the London Fire Brigade, made the startling statement in 1846 that it was his belief that "by long exposure to heat not exceeding 212 deg. timber is brought into such a condition that it will fire without the application of light. The time during which this process will go on until it ends in spontaneous combustion is from eight to ten years, so that a fire might be hatching in a man's premises during the whole time of his lease without making any sign." Among the many instances cited by Mr. Braidwood in support of this statement is one to the effect that a fire in the Bank of England was traced to a stove which was resting on a cast iron plate one inch thick, this in turn resting on concrete two and a half inches thick, which was supported by wooden joists, the joists under the stove igniting. If this is a cause of fire, then the majority of houses heated by means of steam, hot water, and hot air are in constant danger of fire from spontaneous combustion, since the general impression prevails that the pipes and flues for heating can with impunity be placed in contact with timber.

In examining this cause of fires, the first question is whether wood will char at as low a temperature as 212 deg. In tearing down houses for the purpose of rebuilding, the timber in contact with the heating pipes and flues has often been found charred. Charcoal is made for certain purposes in the arts at 300 deg. As the result of experiments performed by myself in the laboratory, small pieces of white pine heated a few hours in an air bath at a temperature of 300 deg. were partially converted into charcoal. Considering these facts, it must be admitted the temperature of 212 deg. is sufficient, if applied for a long time, to convert wood into a partially burned charcoal. Accepting this as a fact, the next point to consider is the degree of heat at which charcoal will ignite. Made from the same wood at different temperatures, the products ignite accordingly; that is, if made at a low heat, it fires from a correspondingly low temperature. It has been determined experimentally that charcoal for making powder, when made at 500 deg., would fire spontaneously at 680 deg., and when wood has been carbonized at 260 deg., a temperature of 340 deg. only was required for spontaneous ignition. Under certain circumstances, charcoal made at a temperature of 500 deg. even will ignite when heated to 212 deg.

So far the discussion of heating pipes and flues as a cause of spontaneous fires has been upon the false idea that they are never heated beyond 212 deg. Under the ordinary pressure of the atmosphere, as when water is heated in the open air, it boils at 212 deg., but if it is heated under pressure, the boiling temperature increases accordingly; for instance, water boiling at a temperature of 212 deg. is under a pressure 147 pounds, equal to a column of water one inch square and about thirty feet high; if the pressure is increased to two atmospheres, the temperature required will increase to 249 deg., and so on, so that when a steam gauge registers 60 the actual pressure is 75 pounds, and the temperature at which the water is boiling as high as 307 deg. The higher the house, the greater must be the pressure, and hence the higher the temperature at which the water boils, and it follows that the pipes must heat hot accordingly, and it is stated that in some systems of water heating the pipes have the water started through them at a temperature of 350 deg.*

Then, where furnaces are used for heating, the temperature in a flue has been found to be 300 deg., at a distance of fifty feet from the fire. Couple these figures with those given in reference to the heat necessary to produce charcoal and cause its ignition, and it must be admitted that these pipes and flues for heating are responsible for many fires. The application of these facts is as follows: After long exposure, the wood in contact with the heating pipes and flues is changed on the surface to charcoal. During the warm season this charred surface absorbs moisture from the air; then in the fall comes a cold spell and heat is turned on, when the moisture is driven from the pores of the charcoal, leaving it in a condition to readily absorb gases. The cold abates and the heat is lowered; fresh air in abundance then passes into the confined spaces where the pipes are generally placed, rapid absorption of oxygen from the air by the charcoal follows, with heating and spontaneous firing as already explained.

The body of the timber is heated, and this heat prevents too rapid cooling of the charred surface when the fresh air passes in, otherwise the charcoal would be placed under circumstances unfavorable to ignition. The experiment of burning iron filings in the flame of a spirit lamp illustrates the influence of division upon the igniting point; now, if the iron is in a pulverulent state, as when made by hydrogen, it will, when freshly made, ignite to a red heat when shaken into the air. Then, if it is true, as stated by an English scientist, that the oxide of iron, if placed in contact with timber and excluded from the air, and aided by a slightly increased temperature, will part with its oxygen and be converted into very finely divided particles of metallic iron, here is another cause of fires from heating pipes. For during the summer the pipes rust, and then when heated the rust is reduced, leaving the metallic iron in the same condition as that made by hydrogen; the temperature is lowered, fresh air appears, and oxygen is rapidly taken up by the finely divided iron, each particle heating so rapidly as to give a red heat to the mass.

I have not been able to prove this experimentally; but as carbon is able to overcome quite strong chemical affinities, and will reduce the oxide under strong heat, theoretically it is possible, and the authorities all tend to prove it. Considering all the points bearing upon hot water and steam pipes, also heating flues, an explanation is found of the great number of fires occurring at the approach of winter, and which are reported as from defective flues, supposed incendiary origin, or causes unknown. Steam pipes packed in sawdust or shavings to retain the heat while steam is conveyed to a distance have given fires. One peculiar and important instance is on record of a fire from steam pipes. In the drying room of a woolen mill, a pine board was placed some three or four inches above the steam pipes to prevent wool from falling upon them. A fire followed, and after being put out, a careful examination determined to the satisfaction of all, that the heat of the pipes had distilled the pitch from several knots in the pine board, and this dropping on the pipes had ignited and caused the fire. The illustration needs no comment, as the lesson is too plain to need pointing out.

EVERY ONE has a cure for sore throat, but simple remedies appear to be most effectual. Salt and water is used by many as a gargle, but a little alum and honey dissolved in sage tea is better. An application of cloths wrung out of hot water and applied to the neck, changing as often as they begin to cool, has the most potency for removing inflammation of anything we ever tried. It should be kept up for a number of hours; during the evening is the usually most convenient time for applying this remedy.

* By the system of low pressure steam heating, which is far the most generally used, the pressure is only from 5 to 7 pounds above that of the atmosphere, with a corresponding temperature of 228 deg. to 235 deg. F.

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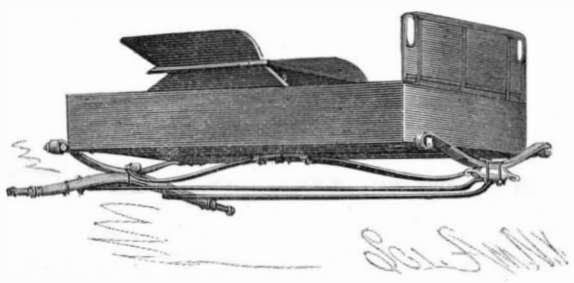
Safety Railway Couplings.

The Amalgamated Society of Railway Servants has invited all owners and inventors of improved safety railway carriage or wagon couplings to communicate with its secretary at the rooms of the Society, 306 City Road, London, E. C., with a view of giving their inventions a practical trial in actual service. The sum of £500 has been set aside by the Society for this purpose. The desirability of such an action is shown by the statistics of the past few years. During the year 1884, 130 persons in Great Britain were killed while shunting cars, and 1,305 were injured. During the seven years preceding 1885, the yearly average of accidents gave 154 killed and 1,322 injured from this cause. In the United States, 459 men were killed in the same manner during 1884.

It is estimated that one man is killed here for each 765,000 freight-train miles, while in England the record is somewhat better, being one man to each 1,010,000 miles. Our readers are familiar with the effort of the Master Car Builders' Association in attempting to decide upon the best coupler among the many good ones of American inventions, and their desire to have it uniformly adopted on all American roads. The problem is somewhat less complicated in England on account of the uniformity of the central drawbar and chain, but it is stated that no satisfactory substitute for the simple hand coupler now in use has yet been invented.

VEHICLE SPRING.

Clips hold the front spring and the front ends of the perches connected with the rear axle to the head block, the nuts of the clips being in recesses in the bottom edges of the block; the rear spring is secured to the center of the axle in the usual manner. The ends of these



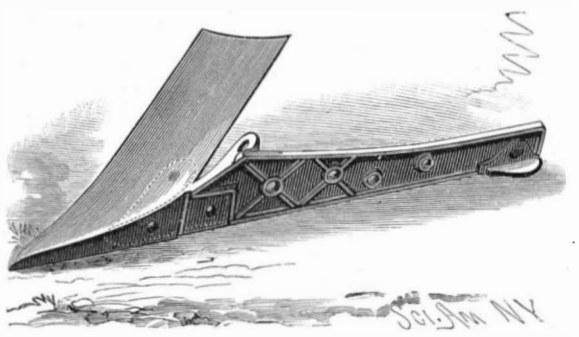
CAIN'S VEHICLE SPRING.

springs are pivotally connected at their outer ends with the four corners of the vehicle body. Longitudinally along the center of the under side of the body is attached a strip or sill, to which the thicker inner ends of brace springs are secured. These springs extend to the ends of the box, and their outer ends are curved and fastened to bolts held on the ends of inwardly and upwardly projecting prongs, held on the head block by the clips and the king bolt, and on the rear axle by clips. The center of the body is thus supported from the front and rear axles. The vehicle rides very easily and gently, as the several springs co-operate, and no side bars, side springs, nor spring bars are required.

This invention has been patented by Mr. Cornelius H. Cain, of 1223 Olive Street, St. Louis, Mo.

IMPROVED PLOW.

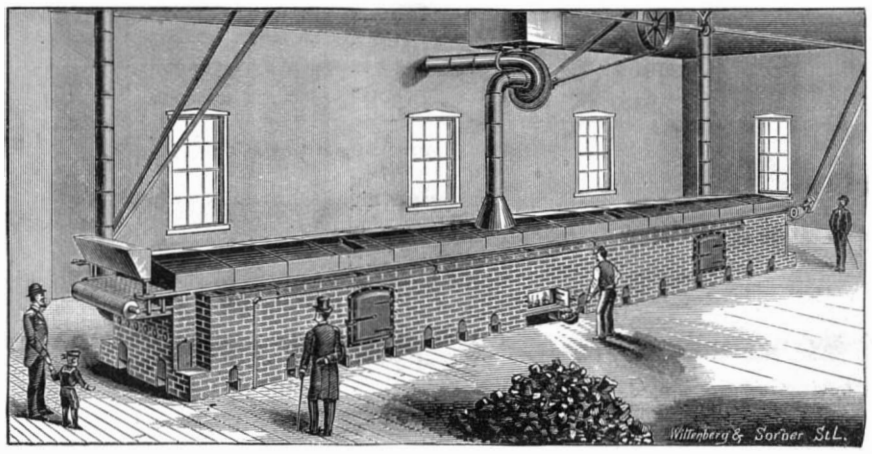
The share is formed solid with the short landside, and fits into a recess in the lower forward part of the extension or long landside. This extension is strengthened and stiffened by flanges and ribs, as shown in the engraving, and is formed with holes that receive the bolts for fastening the landside plate in position; this construction allows the extension to be made lighter than would otherwise be practicable, and at the same time provides a secure and firm support for the plate. Upon



HODGSON'S IMPROVED PLOW.

the inner forward part of the landside are lugs (shown by the full and dotted lines), that receive the bolts holding the share and mouldboard in place; these lugs allow the share and mouldboard to be fitted into place more easily than would be possible if a solid frog or dead lay were used. The lug can be so formed that the same landside can be used with either a single shim or double shim mouldboard. The heel is secured to the landside by a bolt passing through two parallel lugs projecting upward from the middle part, the landside entering between the lugs. The projecting side parts of the heel are made narrower at their outer ends, and the narrow end of the outside one is placed forward. The outer part of the heel is forced into the soil at the base of the shoulder of the furrow, thereby giving steadiness to the plow. When one side becomes worn, the heel can be detached and reversed. If desired, the lugs can be extended, and connected at their ends to form an open welded or cast frog, to be used instead of a solid frog or dead lay when applied to a steel, cast iron, or wrought iron landside.

This plow is the invention of Mr. W. H. Hodgson, Gen. Mgr. of the Winona Plow Co., of Winona, Minn.



WORRELL'S "WEB" DRIER.

IMPROVED DRIER FOR DAMP GRAIN, GLUCOSE, STARCH, ETC.

We herewith illustrate a new invention for drying starch and glucose refuse, brewers' grains, distillery slops, and substances of a similar character, which, from their glutinous nature, have not heretofore been successfully operated upon by existing drying machines. It is also well adapted for handling damp grain and granulated tobacco. The main feature is an endless web or belt of galvanized wire cloth drawn over two large rollers, one journaled at each end of the machine. The edges of this web are sustained by iron plates, which also prevent the escape of hot air at the sides. A number of "idlers" are also provided for supporting the wire cloth and material being dried. The furnace is underneath the drying belt, the firebox being in the middle, and from each side of this extend a number of cast iron heating pipes, that discharge into a soot box at each end of the drier. The entire heating apparatus is covered by dust shields. The brickwork around the furnace prevents the loss of heat by radiation, and furnishes a substantial support for the running gear. Numerous small gates are placed in the bottom of this wall for regulating the distribution of the air currents. The furnace presents a large amount of heating surfaces, means for producing a regular radiation of heat, and easy access for cleaning purposes. Any kind of fuel can be used.

The top of the machine is a close-fitting sheet iron cover, to which is connected the suction spout of a powerful exhaust fan, seen in the top of the cut, to accelerate the upward movement of the hot air, which is the sole drying agent. Drain pipes are supplied for disposing of the condensed water that collects on the interior of the iron cover. Motion is transmitted to the drying web by worm gearing, shown at the extreme right.

In operation, the damp material is spread to an even thickness across the entire width of the upper wire cloth by a sifting device in the bottom of the hopper, at the left of the cut. This action leaves the substance to be dried in a loose, porous condition, so that the air can freely pass through it. By the movement of the web the material is now carried into the machine, where the heat brings the moisture to the surfaces of the particles, and it is absorbed by the air and carried up and discharged through the blower. This action is continued until the material reaches the opposite end of the machine, where it is discharged in a thoroughly dry condition. A revolving brush under the delivery roller removes any particles that may adhere to the wire cloth.

This invention has been patented by Mr. Stanley E. Worrell, of Hannibal, Mo.

POWDERED rice is said to have a great effect in stopping bleeding from fresh wounds.

Ships' Signals.

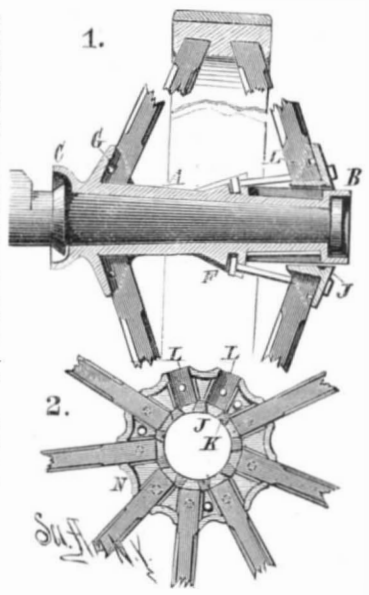
Mr. Donald C. Grant, one of the Forth Bridge staff, according to the *Engineer*, is bringing out a new form of signal for use at sea to indicate to other ships the direction of movement of the helm, so as to avoid collision with ships close up. He does not propose to supersede the side lights at present employed, but only to supplement them. The officer on watch is supplied with a couple of signals small enough to be carried in a breast coat-pocket of ordinary capacity.

Should he wish to indicate that his vessel is on the port tack, he takes a signal—with a round handle and colored red—from his pocket, and fires it by giving it a slight tap. The result is a brilliant red light.

After this light has burned for about 30 seconds, it explodes a small maroon, the report of which can be heard a mile off, and after this the light continues to burn for another 30 seconds. The process of firing the starboard tack signal is, of course, the same, the result being a green light, but in this case the handle is square, this difference of form making it easy in the dark to distinguish the right signal to be employed.

VEHICLE WHEEL.

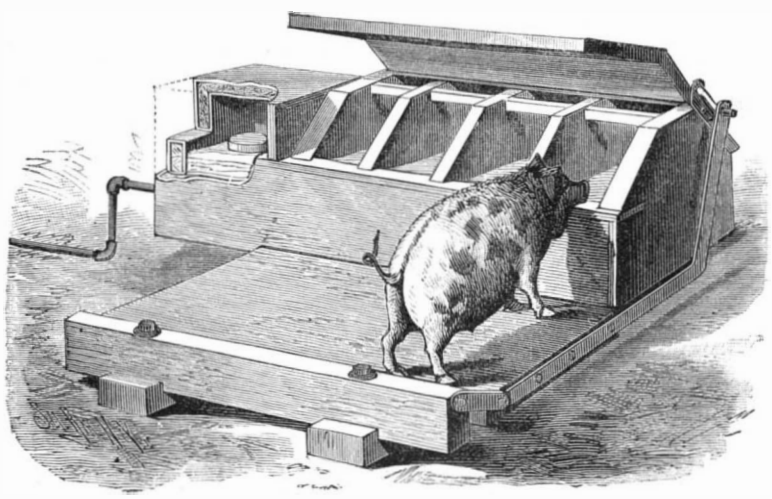
Fig. 1 is a cross sectional elevation, and Fig. 2 is a front view, of the front ring of a vehicle wheel invented by Mr. Henry B. Weinstock, of Fall Creek, Wis. On the front and rear ends of the tapered hub-thimble,



A, are the sand guard flanges, B, C. Cast on the thimble a short distance from the front end is a ring or lug, F; and at the rear end is a ring of pockets, G, provided with pins and open toward the front. Fitting on the front end of the thimble is the ring, J, formed with three longitudinal grooves, K, in its inner side for receiving tapered keys cast on the thimble. This ring has as many pockets as there are pockets, G, on the thimble. The ends of the rear spokes are placed in the pockets, G, the pins passing into the outer faces of the spokes, and the ends of the front spokes are placed in the pockets in the ring, the pins entering their outer edges. The outer ends of the spokes are mortised in a wide felly. The ring, J, is held by bolts, the heads of which are held in recessed lugs on the thimble, as shown clearly in Fig. 1. This construction forms a strong and durable wheel.

AN AUTOMATIC AND NON-FREEZING STOCK WATERING TROUGH.

Farmers and stock raisers will find, in the contrivance for watering stock herewith illustrated, a con-



BOIES' STOCK WATERING TROUGH.

struction calculated to save time and trouble, promote cleanliness, prevent waste of water, and yet always perform the service required. The platform in front of the trough is arranged to have an up and down movement, and is so connected by short rods, and a crank rod and crank arms, with the cover that when the hog or other animal steps upon it the cover will be

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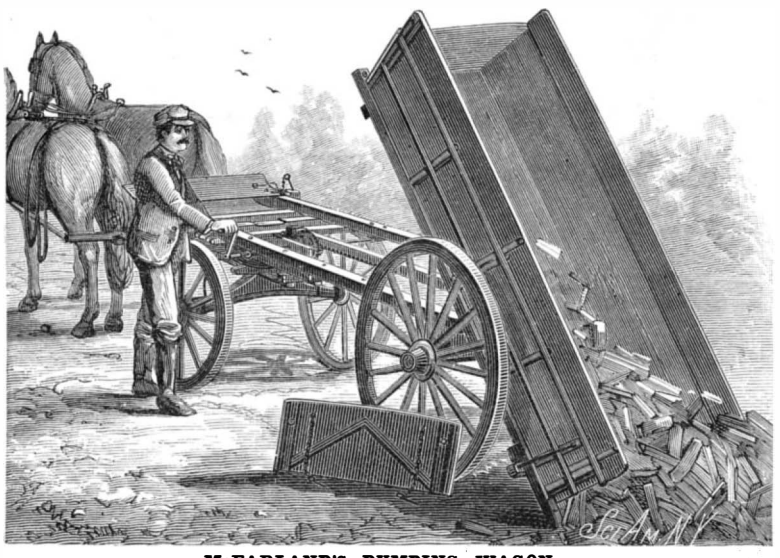
raised, as seen in the illustration; and when the animal steps off, the platform will return to its normal position, and the cover will automatically close over the trough, the cross bars across the top preventing the stock from putting their feet in the trough, and defiling the water. The trough is made in two compartments, of which the one at the left, in the engraving, receives water direct from a tank or reservoir. This compartment is connected with the other by an opening, so that the water will always stand at the same height in both compartments, but the height of the water in the first division is controlled by a stop cock



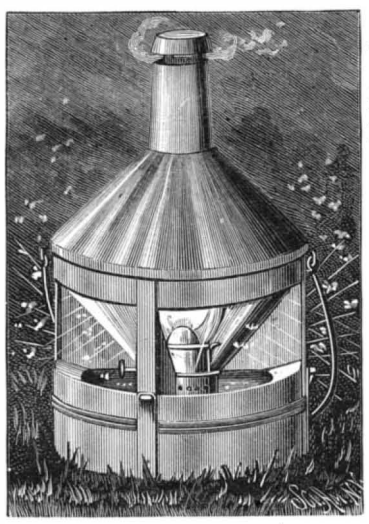
McFARLAND'S DUMPING WAGON.

actuated by a float, which admits water when it falls below a certain level and cuts off the supply as it rises above that level, so that there can be no overflow or waste of water. The sides, ends, and bottoms of the trough, and its covers, are all made with double walls, the space between them being carefully packed with asbestos millboard, as a non-conductor of cold or heat, making a substantial protection against the freezing of the water in cold weather, a difficulty which many of the farmers in some our Western States, where water is scarce, have found to be a most serious one. The cover has a small aperture with which the interior of the trough may be ventilated, and the interior partitions are so made that they can be readily removed for cleaning.

This invention has been patented by Mr. Thaddeus W. Boies, of Beloit, Kan.

INSECT DESTROYER.

During the past summer the insect destroyer shown in the accompanying engraving gave most satisfactory results during thorough and practical tests by the inventor, Mr. Dudley H. Manning, of Sibley, Iowa. The under surface of the conical top, through the center of which the chimney passes, is bright, as are also the partitions that extend inward from the upright of the frame and carry the socket for receiving the lamp.



Panes of glass are held between the inclined inner edges of these partitions, thus forming an inverted conical glass casing around the lamp. The entire apparatus is placed on top of a vessel partly filled with water. The various mirrors reflect the light upon the water, illuminating it very brightly. Insects of nocturnal habits—moths, beetles, etc.—fly toward the light and into the brightly illuminated water, where they perish, or, striking the cone, are thrown downward into the water. An inverted conical ring placed just above the water prevents their escape. The water in the pail may be poisoned or may be sweetened. The top can be easily detached from the base, and the whole apparatus can be carried from place to place by the bail.

MESSRS. PEARS, the celebrated English soap makers, and remarkable for the extent and novelty of their advertisements, offered some time ago a prize of £100 for the best essay on "The Depression of Trade." The general purport of the essays is to the effect that depressions are periodical, and followed by activity; that the present depression is not worse than others that have preceded it; that a future of prosperity must be close at hand; that the causes of the depression are most complex, and the remedies must be similarly various.

AN IMPROVED DUMPING WAGON.

From the accompanying picture the reader can readily understand the general principles on which this wagon is built, but it has some novel features calculated to attract the attention of makers and users of wagons of this character. The box and its supporting frame are slightly wider at the rear than in front, yet the guide pieces are made to work back and forth in parallel lines, so that the box will readily free the load in dumping, while the gear for moving the box is at the back of the chair of the wagon, where the front wheels will come back of it and not interfere with turning the wagons in short curves. The operation of the shafts and intermeshing gear wheels, in connection with the connecting rod and rack, for moving the box of the wagon back and forward, will be readily understood from the engraving, there being hooked guide plates on the sliding frame of the box that engage pinions on the sills of the wagon to limit the backward movement of the box.

There are also plates on the forward end of the sliding frame of the box, which lock in loops on the sills as the box is moved forward, the locking devices preventing bouncing of the box when the wagon is going over rough roads or pavement.

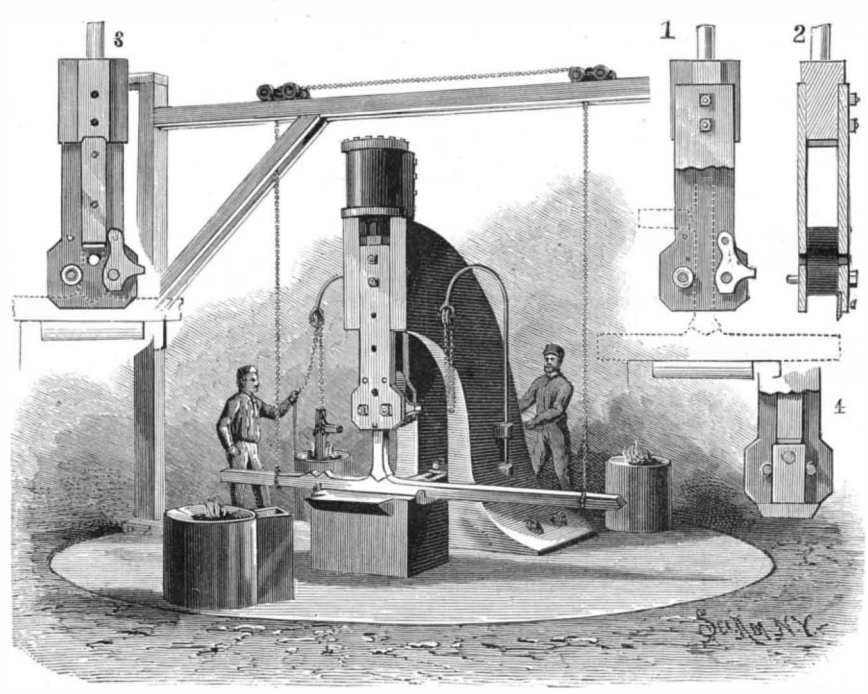
This invention has been patented by Mr. James McFarland, of 235 Main St., Louisville, Kentucky, and wagons are being made according thereto at the factory of Mr. William Tingley, No. 231 East Main Street, in that city.

HAMMER FOR WELDING LOCOMOTIVE FRAMES.

Near the center of the base plate is mounted a steam hammer, grouped in a circle around which are three furnaces, the one in front being provided with two fires and used for heating the main frame and braces, and the side ones for heating the legs of the pedestals. In the front edges of the standards of the hammer are grooved guides, in which slides the hammer head, provided with removable plates carrying the various dies used in welding the different parts of the frame. The anvil is made with an extension placed between the standards, and fastened by a bolt and nut to the base plate of the hammer. A slot in the extension, through which the bolt passes, makes the anvil adjustable, so as to weld on its center or on its front horn, as desired. On top of the anvil are guide stops, against which rests the rear edge of the pedestal of the frame while being welded, and it is provided on each side with pivoted catches to hold the pedestal in place. At each side of the standards is a davit for lifting and swinging the legs of the pedestal to and from the hammer and side furnaces. The main base plate carries a swinging crane having chains, pulleys, runners, etc., to which the pedestal of the frame is attached near its ends, so as to be easily manipulated under the hammer, and be swung to and from the main furnace. Passing through holes near the lower ends of the side plates are steel pins; on one pin is a bushing for forging the rounded outside part of the pedestal to which the legs are welded, and on the other pin is a die shaped to forge the inclined inside of the pedestal.

Fastened between the plates by pins is a center bar, Fig. 3, which reaches to and enters a recess in the bottom of the hammer head. The dabs to be welded are placed between the bushing and die, when the hammer head strikes the dab through the center bar and forges it to the leg, as shown by the dotted lines, Fig. 3. The bushing and its pin, and the center bar, are then removed, and the leg of the pedestal is placed between the plates and against the die, when the bushing is replaced. The pedestal of the frame to which the leg is to be welded having been formed under the hammer to the desired shape for the lower end of the leg, the frame is swung from the main furnace to the anvil, and the heated leg set in position on it, as shown by the dotted lines in Fig. 1. The hammer head then strikes the top of the leg and forges it to the pedestal, the bushing, die, and side plates acting as guides for the leg. On the lower end of the outer plate is a steel cutter that assists in welding, and cuts the sides to the proper size of the pedestals. The leg can be taken from the plates by removing the bushing. Fig. 4 is a front elevation of the hammer block, showing a die for welding the braces to the frame. The braces are heated with the main frame over the front furnace, which is provided with two fires.

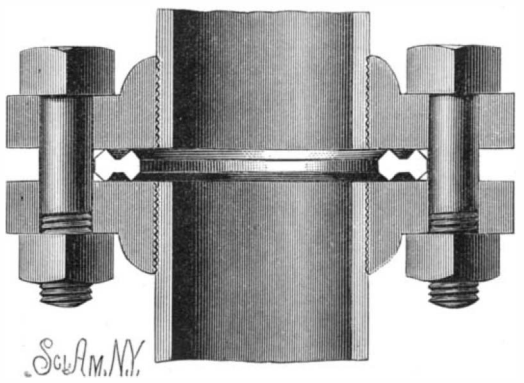
The difficulty of obtaining perfectly welded locomotive frames by blows of heavy sledges is well known; but by means of the hammer above described each weld can be perfectly made, and the parts can be easily handled and brought under the hammer. The inventor of this hammer, Mr. John R. James, of Dunkirk, N. Y., is confident that with this hammer and the aid of three men he can do more and far superior work than with seven men in the old way.



JAMES' HAMMER FOR WELDING LOCOMOTIVE FRAMES.

PACKING FOR STEAM PIPE JOINT.

The accompanying illustration represents two meeting lengths of pipe, each of which is threaded to engage with an internally threaded coupling flange. The flanges are united by bolts in the ordinary way, but instead of the usual rubber or soft metal packing ring, a steel or iron ring is placed between the flanges. This ring consists essentially of two or more concentric ridges projecting from each side of a central web. The bearing edges of these ridges are V-shaped, and all are of the same height; and, being sharp and preferably made of steel, they will, to a certain extent, cut into the flanges. It will be seen that the packing ring may



LYONS' PACKING FOR STEAM PIPE JOINT.

be used upon the ordinary form of flanged coupling piece, without the slightest alteration of the coupling. This packing is more particularly designed for use when the joint is subjected to a high degree of heat.

This invention has been patented by Mr. J. B. Lyons; further particulars can be obtained by addressing F. L. Hirschmann, M.D., of Norway, Mich.

Artificial Leather.

Artificial leather is, according to a French invention recently patented, made by a cotton fabric, the warp threads of which are very slightly twisted, and the weft threads of which are finer than usual. This fabric is serrated on both sides, and immersed in a preparation consisting of a decoction of linseed, rabbit skin glue, linseed oil, and coloring matter. When the fabric is impregnated with this preparation, it is stretched upon a polished zinc plate laid upon a steam heated hot plate, the drying being continued until the aqueous portion is entirely evaporated. It is claimed that this artificial leather is an excellent imitation of the real thing.

FARADAY proved the magnetic condition of matter, and that magnetism, unlike electricity, cannot be insulated.

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THE NEW TAY VIADUCT.

(*Continued from first page*).

the platform, and are provided with apertures of the same diameter and spacing as the preceding. Moreover, the plates, D D, are provided with a longitudinal grove of a length equal to that of the stroke of the piston of the hydraulic engine. The ascent is effected as follows: Let us suppose the piston at the end of its stroke; the apparatus is keyed by passing a steel pin into the apertures of the guide bars, B, and into the head, I, of the piston. The admission of water above the latter presses the pin against the bars, B, and, as the column with which these are connected is bearing against the ground, the cylinder, E, is forced to rise and carry along the plates, D, along with the platform. When the entire affair has risen 6 inches, the apertures in the plates, D, come opposite those in the bars, B B, and a second pin is then passed into the corresponding apertures under the piston. The water contained in the cylinder, E, is then expelled, and the platform rests upon the lower pin that has just been inserted, thus allowing the other one to be removed. It is now only necessary to cause the piston to rise, and to replace the first pin, to prepare the system for an ascent. The descent is effected by proceeding in just the opposite way. The two cylinders, E, of each column are always conjugate, and can, when necessary, be joined to those of the other columns.

The method employed for submerging the cylindrical caissons is based upon the same principle. The caissons weigh, on an average, 50 tons, inclusive of the brick filling which is put in during the sinking. Four rods, L, of square section (Nos. 2 and 3, Fig. 5) are fixed at their lower end to a strong disk riveted to the caisson, and slide in a piston having a hollow rod, P, movable in a cylinder, A, on the platform. This cylinder is surmounted by a crosspiece, B (Fig. 5), which gives passage to the rods, L, which latter contain three rectangular apertures. When at rest, a bar inserted at K in one of these apertures holds the caisson. Let us suppose that each piston, P, has reached the end of its stroke; the cock, Q, that admits water is closed, and a bar is inserted in the hole, M that succeeds the hole K. Then the cock is opened so that the whole apparatus shall be supported by the piston, thus allowing of the removal of the bar inserted in the hole, K. Upon then opening the eduction, the piston and caisson descend together as far as the end of the former's stroke. At this moment a bar is inserted in the hole that has reached the level of the crosspiece, and everything is now ready for a second operation. The caisson thus gradually descends to the bottom.

From what precedes, it may be easily seen how the piers are constructed. The pontoon is set afloat, and hauled to the spot selected for the foundations by means of the service crane and of capstans around which wind cables fixed to the piers of the old bridge. Then the temporary supports that sustain the columns are removed, and allowed to rest upon the ground, care being taken to open the water valves of the caisson in order to prevent the pontoon from floating when the tide is rising. The platform is then raised to a proper height by means of the hydraulic cylinders. The stability of the whole is secured by means of anchors and chains.

The construction and submersion of the foundation caissons is performed as follows in the openings of the platform:

The rings are brought to the spot all prepared for being placed in position to be riveted together. While the riveting is being done, a lining of bricks is constructed in order to increase the caisson's weight. During the mounting of the sections, the entire affair is gradually let down by means of the hydraulic cylinders above described until the caisson touches bottom. The excavating apparatus are then set in motion, and the caisson sinks by its own weight (which, when necessary, is increased by a surcharge) until it reaches the proper depth. The interior is afterward filled in with concrete, and the foundation caisson is finished. When the second caisson has been finished in a similar manner, the platform is removed to another point of the work. This is done by lowering it to the proper level for floating, and then towing it to the desired spot.

When the pontoon has been removed, it remains to build the masonry pier up to the level of the octagonal metallic pier which is to surmount it. To this effect, temporary caissons are bolted to the main one before sinking it. These serve both for carrying the additional load above mentioned and for guiding the caisson during its descent. After exhausting the water from the latter the masonry is completed, and an anchor bolt two inches in diameter is inserted 20 inches beneath the summit. When the upper masonry is finished, the temporary caissons are unbolted, and those pieces are adjusted that serve to connect the metallic part of the piers with the masonry.

In short, the work is performed in the following order: 1. Putting the pontoon in place, descent of the caisson, excavation, and filling with masonry. 2. Tests of the strength of the foundation. 3. Construction of the upper masonry of the piers beneath the level of high water. 4. Finishing the pier up to the level of the octagonal metallic portion.

Four of these pontoons are now in use, the largest of which is 82 feet in length by 65 in width, and the smallest 55 by 36 feet. They are proportioned to the dimensions of the piers to whose construction they are to be applied. This very ingenious device can be economical only for large works, where there is quite a number of piers to be constructed. At the Tay viaduct it is giving excellent results. On the north shore (Dundee side), it has permitted of sinking and finishing one pier per week, consisting of two caissons 10 feet in diameter.

The work was begun in June, 1882. At present the masonry arches of the two extremities are finished, and nearly all the foundation caissons are sunk and filled. Half of these have received the octagonal piers, and part of the bridge, with its railway track, is now completed for a total length of 1,640 feet. The girders and superstructure of the 13 middle spans are being put together upon a scaffolding at the extreme south of the work. When the parts for each span have been assembled, the irons will be placed upon the caissons already constructed, and will afterward be raised by hydraulic engines to the height that they are to occupy upon the octagonal piers.—*La Nature.*

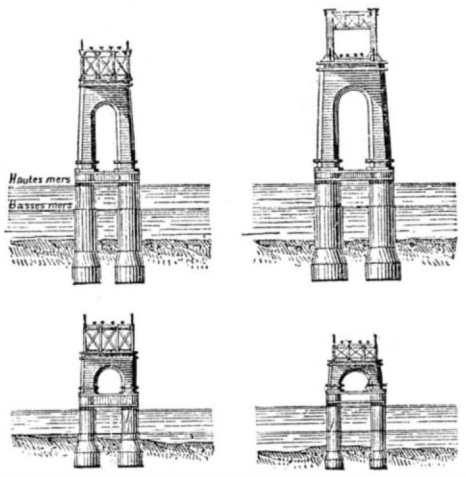

Fig. 3.—ELEVATIONS THROUGH A, B, C, AND D.

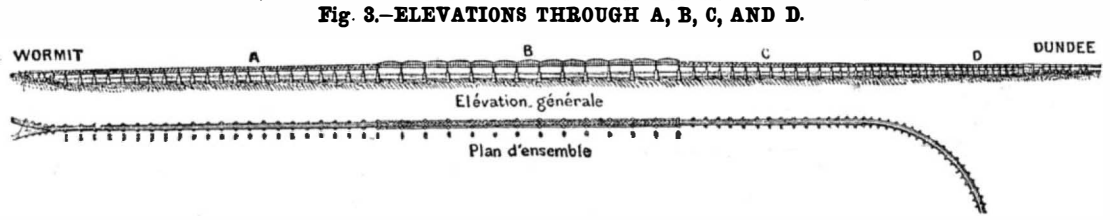

Fig. 4.—TAY VIADUCT.

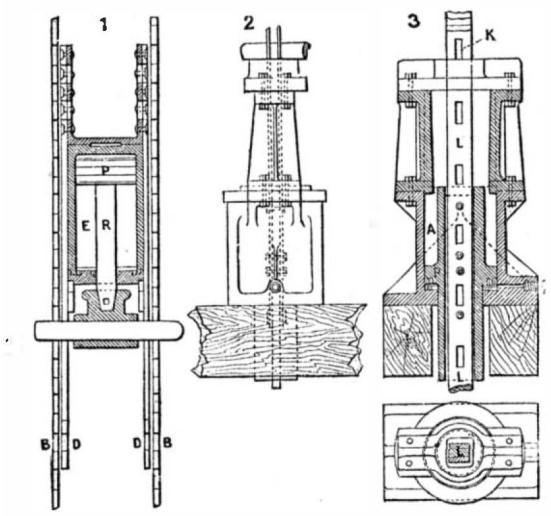

Fig. 5.—HYDRAULIC CYLINDER, FOR RAISING AND LOWERING MOVABLE PLATFORM.

The Sun's Corona.

Signor F. Tacchini, the successor of Signor F. Secchi at the Observatory of the Collegio Romano, has published a confirmation of the astronomer Forel's statement that the sun's corona is, in a clear sky, discernible on high mountains in a surprisingly distinct manner. He himself observed the phenomenon from the summit of Ætna at the beginning of July. At Rome, Naples, Messina, Catania, the sun appeared surrounded by a broad white crown; but from the top of Ætna, 3,300 meters above the level of the sea, in a very clear sky, it presented the appearance of a white ring surrounded by a splendid copper red corona. Near the horizon, the sun's appearance changed into an ill-defined arch of great span. He was able to observe all these phenomena at leisure on two different days. At sunrise and sunset he saw clearly the beautiful red light of the arch. But he is of opinion that those appearances are not as strong and brilliant this year as in 1833 and 1884.

Management and Care of Steam Boilers.

The following summary is issued by the Hewes & Phillips Iron Works, of Newark, N. J., and it comprises useful information to all in charge of engines:

"The first duty of an engineer, when he enters his boiler room in the morning, is to ascertain how many gauges of water there are in his boilers. *Never unbank nor replenish the fires until this is done.* Accidents have occurred, and many boilers have been entirely ruined, from neglect of this precaution.

"In case of low water, immediately cover the fires with ashes, or, if no ashes are at hand, use *fresh coal.* Do not turn on the feed under any circumstances, nor tamper with or open the safety valve. Let the steam outlets remain as they are.

"In cases of foaming, close throttle, and keep closed long enough to show true level of water. If that level is sufficiently high, feeding and blowing will usually suffice to correct the evil. In cases of violent foaming, caused by dirty water, or change from salt to fresh, or *vice versa*, in addition to the action before stated, check draught and cover fires with fresh coal.

"When leaks are discovered, they should be repaired as soon as possible.

"Blow off 8 or 10 inches at least once a week; every Saturday night would be better. In case the feed becomes muddy, blow out 6 or 8 inches every day. Never blow entirely off except when boiler needs scraping or repairing, and then not until fire has been drawn for at least ten hours, as boilers are often seriously injured or ruined by being emptied when the walls are hot. Where surface blow-cocks are used, they should be often opened for a few moments at a time.

"After blowing down, *allow the boiler to become cool* before filling again. Cold water pumped into hot boilers is very injurious from sudden contraction.

"Care should be taken that no water comes in contact with the exterior of the boiler, either from leaky joints or other causes.

"In tubular boilers the hand-holes should be often opened, and all collections removed from over the fire. Also, when boilers are fed in front and blown off through the same pipe, the collection of mud or sediment in the rear end should be often removed.

"Raise the safety valves cautiously and frequently, as they are liable to become fast in their seats, and useless for the purpose intended.

"Should the gauge at any time indicate an excessive pressure, see that the safety valves are blowing off. In case of difference, notify the parties from whom boiler was purchased.

"Keep gauge cocks clear, and in constant use. Glass gauges should not be relied on altogether.

"When a blister appears, there must be no delay in having it carefully examined, and *trimmed* or *patched*, as the case may require.

"Particular care should be taken to keep sheets and parts of boilers exposed to the fire perfectly clean, also all tubes, flues, and connections well swept. This is particularly necessary where wood or soft coal is used for fuel.

"Under all circumstances keep the gauges, cocks, etc., clean and in good order, and things generally in and about the engine and boiler room in a neat condition.

"Barium chloride and milk of lime are said to be used with good effect at Krupp's Works, in Prussia, for waters impregnated with gypsum.

"Soda ash and other alkalies are very useful in waters containing sulphate of lime, by converting it into a carbonate, and so forming a soft scale easily cleaned; but when used in excess they cause foaming, particularly where there is oil coming from the engine, with which they form soap. All soapy substances are objectionable for the same reason.

"Petroleum has been much used of late years. It acts best in water in which sulphate of lime predominates. As crude petroleum, however, sometimes helps in forming a very injurious crust, the refined only should be used.

"Rogers' tannate of soda is probably the best preparation for general use, but in waters containing much sulphate it should be supplemented by a portion of carbonate of soda or soda ash.

"For muddy water, particularly if it contain salts of lime, no preventive of incrustation will prevail except filtration; and in almost every instance the use of a filter, either alone or in connection with some means of precipitating the solid matter from solution, will be found very desirable.

"In all cases where impure or hard waters are used, frequent 'blowing' from the mud drum is necessary to carry off the accumulated matter, which if allowed to remain would form a scale."

BEWARE of long, crooked suction pipes, when erecting a pump. Bends, returns, and angles increase friction very rapidly. Also remember that doubling the diameter of a pipe increases its capacity four times.

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Correspondence.

How to Cure Stammering.

To the Editor of the Scientific American:

Referring to No. 18 of Notes and Queries, of your issue of December 19, would say that if O. C. P. will always fill his lungs with air by a strong inhalation before he begins to speak, he may very readily cure the most obstinate case of stammering. At least that is the personal experience of the writer.

CHAS. F. PENNMAN.

Asheville, N. C., December 20, 1885.

Bell not the Inventor of the Speaking Telephone.

To the Editor of the Scientific American:

There is a phase of the telephone controversy which I do not remember to have seen referred to, namely, that Prof. Bell's title to his telephone patent of 1876 is at best *only legal*, which so interpreted has been sufficient so far for his purpose. It is not true *historically* that he was the inventor of the first speaking telephone. Leaving out all that Reis did and said about his telephone, it is nowhere denied, and is everywhere believed, that Yates, of Dublin, did make and use a telephone, which for substance was identical with the caveat of Gray, and which Bell himself used for his first success in speech transmission. Yates' experiments did not happen to be published, though there were, and still are, several witnesses to their success, and the instruments have been produced in a London court. Therefore, if it be allowed for the argument's sake that Reis did not transmit speech, it cannot be allowed that Yates did not; and hence, if Reis was not the inventor of the first speaking telephone, Yates was. This is simple history, and is not subject to legal quibbles. Happily, there are no legal priorities in matters of history.

Admitting the necessity for a law as to priorities in invention, and even admitting its applicability in this special case on account of the lack of publications of Yates' work at the time, it still does not in truth follow that Prof. Bell was the inventor of the first speaking telephone; and though he holds a legal patent, it is only upon *technical grounds*, and ethically it is neither just nor honorable that he should be considered the inventor of the first speaking telephone.

Courts construe law and courts *make* law when they see fit, and whether they do the one or the other, depends in a good measure upon their environment.

A. E. DOLBEAR.

College Hill, Mass., Dec. 21, 1885.

Starting the Ship Railway Trains.

To the Editor of the Scientific American:

In reading the very interesting letter of Mr. C. H. Needham in your issue of December 19, about the power required for the ship railway, considerable unnecessary stress was laid on the extra power required to start such a large mass as a ship and cargo. If it requires 25 per cent more to start a train than to keep it in motion afterward, would not the car be started by having either end of the road depressed sufficiently, so the car would start by merely loosening the brakes? This would seem to me desirable, even if the slight depression at the immediate end of the line had to be recovered after the car got in motion. It would also tend to stop the car at the end of its journey, which with such a massis no small consideration. I hope that this small and original (as it would seem from the above mentioned letter) suggestion may be used to advantage.

E. STANLEY GARY.

Baltimore, Dec. 17, 1885.

[Mr. Gary's suggestion would possess greater merit if he had told us how he proposes to start the car on any intermediate part of the line. It will doubtless be necessary sometimes to stop the engines temporarily at points between its terminals, to readjust some of its moving parts, tighten up nuts, or relieve a heated axle, as in ordinary railway practice; and as a moderate increase of diameter of cylinder over the ordinary requirements of the present railways will, as was shown in our issue of December 19, furnish all the extra power required to start the ship railway train, and do it both economically and with certainty, we fail to see the advantage of Mr. Gary's suggestion.—ED.]

The Kansas Grasshopper.

It is reported that the citizens of Helena, Ark., were recently aroused early in the morning by what seemed to be a heavy rainstorm, but they found the sky perfectly clear, and the air full of dark flakes which afterward proved to be a cloud of grasshoppers. They pattered against the roofs and windows of the houses with so much force and in such large numbers that they simulated rain. People who had seen the dreaded pests before, when they descended upon the grain fields of Kansas and consumed every blade in a few hours, say that the numbers exceeded even that visitation. They were passing westward. Many of them were disabled by hitting against buildings and other obstructions, as they flew very low, and had to be shoveled off the sidewalk in the street. They were apparently genuine Kansas grasshoppers.

The Equatorial Telescope and its Operation.

ISAAC SHARPLESS.

It is a mistaken idea that to study astronomy successfully a great telescope and the resources of a fixed observatory are essential. The observers of the East in ancient times, with nothing to use but their trained eyes and quickened intellects, saw a multitude of sights in the heavens of which those of us who are not astronomers, but who have plenty of facilities, never think. The sun, the moon, and the stars roll around us with a regularity and precision which have no counterpart in nature or in human handicraft, and to observe and test this regularity requires instruments and appliances of the most delicate sort. It is for this mathematical part of astronomy, *practical* astronomy, in the common sense of the word practical, and not for the purposes of the unprofessional observer, that the extreme delicacy of construction and mounting of astronomical instruments is needed.

If the earth, our station for observing, stood still, it would greatly simplify the problems to be dealt with. But when it is traveling through space at the rate of something like one and a half millions of miles a day, and also whirling daily about its own axis, an element of difficulty is introduced. If our telescope is pointed at an outside object, in a minute it will point in another direction. To study attentively anything which requires time, this motion of our earth must be counterbalanced by a motion of the telescope in a contrary direction. It is as if we were intently examining a point of the landscape, with a spy glass, from the window of a rapidly moving train. Evidently the spy glass cannot be rigidly attached to the framework of the car, but must be in continual motion. It is for securing a result similar to this that the common form of mounting for telescopes, the "equatorial," is devised.

But let us begin at the base. The pier of solid masonry on which the telescope is to rest is set on a firm foundation, several feet under ground. The surface ground should not come in contact with this pier, for the tremors of the earth are communicated by some kinds of strata to a long distance. A railroad train shakes the earth, sometimes for a half a mile on each side. At Columbia College Observatory, close to the N. Y. Central R.R., all observations have to cease when a train passes. City observatories are nearly always defective for this reason.

The pier is extended upward to a height necessary to give a good horizon. If too tall, the element of instability enters. Modern telescopes are mounted lower than what was thought necessary a few decades ago—astronomers preferring to have part of their horizon obscured rather than take any risks of tremors.

The house which surrounds the pier is built entirely separate from it, being framed around it without contact. Otherwise the motion of a person about the rooms, or the wind striking the outside, will produce a very decided quivering of the instrument. We have known a large telescope to become almost useless be cause a piece of mortar, dropped by a workman, had hardened between the pier and the framework of the building, though the pier was in this case solid brickwork, six feet square.

The telescope room is surmounted by a hemispherical dome which runs on a horizontal track around the base. Sometimes this is merely an iron track, sometimes the dome rests on iron balls, and a great many devices for equalizing pressure and destroying friction are often used. The new dome, forty feet in diameter, just completed for the great telescope of the University of Virginia, can be turned by the force of about ten pounds applied at its base in the direction of its motion.

The great observatory at Nice in France, created by the liberality of M. Bischoffsheim, has its large dome floating in a circular tank, the liquid in which takes nearly all the weight off the supports. Of course this is not available in climates where such great cold is felt as in ours, as the liquid would freeze.

In the dome is a shutter, to open when the telescope is to be used. By revolving the dome, this shutter, which extends all the way to the apex, can be brought so that any point of the heavens can be viewed by the telescope.

On the pier within the dome is the telescope. To readily counteract the rotation of the earth, one of the axes of the telescope is made parallel to the axis of the earth, or pointing nearly to the North Star. A series of wheels run by a weight will move the telescope slowly around this axis, and a governor regulates the speed. When the telescope is pointed at a star, it is clamped to the axis, the clockwork is set in action, and if properly regulated, as fast as the rotation of the earth would carry the telescope eastward, the weight would carry it westward. Thus, as the star rises, crosses the meridian, and sets, the telescope follows it. By occasionally winding up his clock, the astronomer has no concern after once finding his star. He may leave the room, sure that on his return the image of the star will still be there in his tube. If his telescope axis were not parallel to that of the earth, this could not be so readily arranged. But the stars seem in their diurnal rotation to move about an axis running north and south, with the north end tilted up at an angle equal to the latitude of the place. If the telescope also moves about such an axis, all that has to be done is to regulate its motion to the right velocity, and we have a perfect counteraction to the earth's rotation.

When the astronomer desires to bring his telescope into action, he first opens the shutter and revolves the dome, so as to bring the opening in the direction of the desired object. Then by his finder, a little telescope set by the side of his large one and embracing a large field of view in the sky, he points the telescope aright; having now the object in his large tube, he fastens the clamping screws and releases the clock, so as to keep the telescope on the object. If these operations have slightly disarranged his tube, by a system of cords and levers reaching to the eye end of the telescope, and which he handles while looking into it, he makes the necessary adjustment. The observing chair, a sliding seat mounted on a step ladder, adjustable to all different heights, he places in position. His dark lantern to read the graduated circles of the instrument is at his side. With pencil and note-book in easy reach he is ready for work, only to be interrupted by the necessity of occasionally winding the clock and shifting the dome. Many of the larger telescopes have little telescopes leading from the circles to the eye end, so that all may be read without leaving the chair. A little lamp lights up the figures and divisions, so they may readily be seen. Save that the temperature must be that of the outside air, the observer may do his work in entire comfort. Some of them are too Spartan in their zeal to take advantage of these luxuries; but discard the chair for a platform, on which they stand twisting their necks into most abnormal positions.

The work of an astronomer is not all poetry. Sitting before a telescope with the thermometer close to zero, and a wind raging without, with benumbed fingers and cold feet, when the clock won't work for the stiffening of the oil, and the shutter becomes frozen on its track, working alone in the stillness of the midnight or morning hours, requires as much the spur of strong incentive as any other unpleasant employment.

Haverford College, Pa.

Our Mining Industries.

The report of the United States Geological Survey shows that the mining industries of the United States are assuming giant proportions. Not less than $800,000,000 is invested in mining enterprises as productive capital, and over 400,000 people are furnished employment, and the mineral product of the United States for the year 1884 had a value of $413,104,620. The following is a detailed statement of these mineral products as shown by the statistics collected by the United States Geological Survey:

	Quantity.	Value.
Pig iron, long tons	4,097,868	$73,761,624
Silver, troy ounces	37,744,605	48,800,000
Gold, troy ounces	1,489,949	30,800,000
Copper, pounds	145,221,934	17,789,687
Lead, short tons	139.807	10,567,042
Zinc, short tons	38,544	3,422,707
Quicksilver, flasks	31,913	936,327
Nickel, pounds	64,550	48,412
Platinum, troy ounces	150	450
Aluminum, troy ounces	1,800	1,350
Bituminous coal, long tons	73,730.539	77,417,066
Pennsylvania anthracite, long tons	33,175,756	66,331,512
Petroleum, barrels	24,089.758	20,476,294
Lime, barrels	37,000,000	18,500,000
Building stone		19,000,000
Salt, barrels	6,514,937	4,197,734
Cement, barrels	4,000,000	3,720,000
Limestone for iron flux, long tons	3,401,930	1,700,965
S. Carolina phosphate rock, long tons	431,779	2,374,784
New Jersey marls, short tons	875,000	437,500
Borax, pounds	7,000,000	490,000
Mica, pounds	147,410	308,525
Zinc white, short tons	13.000	910,000
Natural gas		1,460,000
Other mineral products		11,062,631
Grand total of mineral products		$413,104,620

Requirements of the Canadian Patent Law in Respect to Manufacture of Patented Articles.

The Bell telephone patents having been declared invalid in Canada for the reason that they had not been manufactured in accordance with law, a suit was lately brought to upset the Edison telephone patents on the same ground. The Minister of Agriculture has, however, decided that in the case of the Edison patents the law has been complied with, and the patents stand. He says:

"A patentee is within the meaning of the law, in regard of his obligation to manufacture, when he has kept himself ready either to furnish the patented article or to sell the right of using, though, may be, not one single specimen of the article has been produced, and he may have voided his patent by refusal to sell, although his patents were in general use.

"In this case there is absence of the proof, without which no patent should be considered forfeited.

"Therefore, Thomas Alva Edison's Patents No. 8,026, for telephonic communication, No. 9,922, for improvements in telephone, and No. 9,923, for improvements in telephones and circuits, have not become null and void under the provisions of Section 28 of the Patent Act of 1872."

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IMPROVED PLATE BENDING MACHINE.

At the Oldfield Road Ironworks have been produced recently some good specimens of plate bending rolls, some notion of which may be obtained by a glance at the annexed illustration.

The rolls are 18 ft. 6 in. long, the distance between the standards being 19 ft. The top roll is 27 in. diameter, and the two lower ones 19 in. diameter; these latter are fluted from end to end, to secure a better grip of the plates. From the great size of the top roll (the weight being 10 tons), it will be seen that special provision must be provided for raising and lowering, otherwise too much effort would be required of the workmen. The difficulty has been met by balancing this roll by means of two large pans suspended from the end of a suitable lever underneath the framework of the machine. On the opposite ends of these levers to the pans rest the vertical rods which support the top roll.

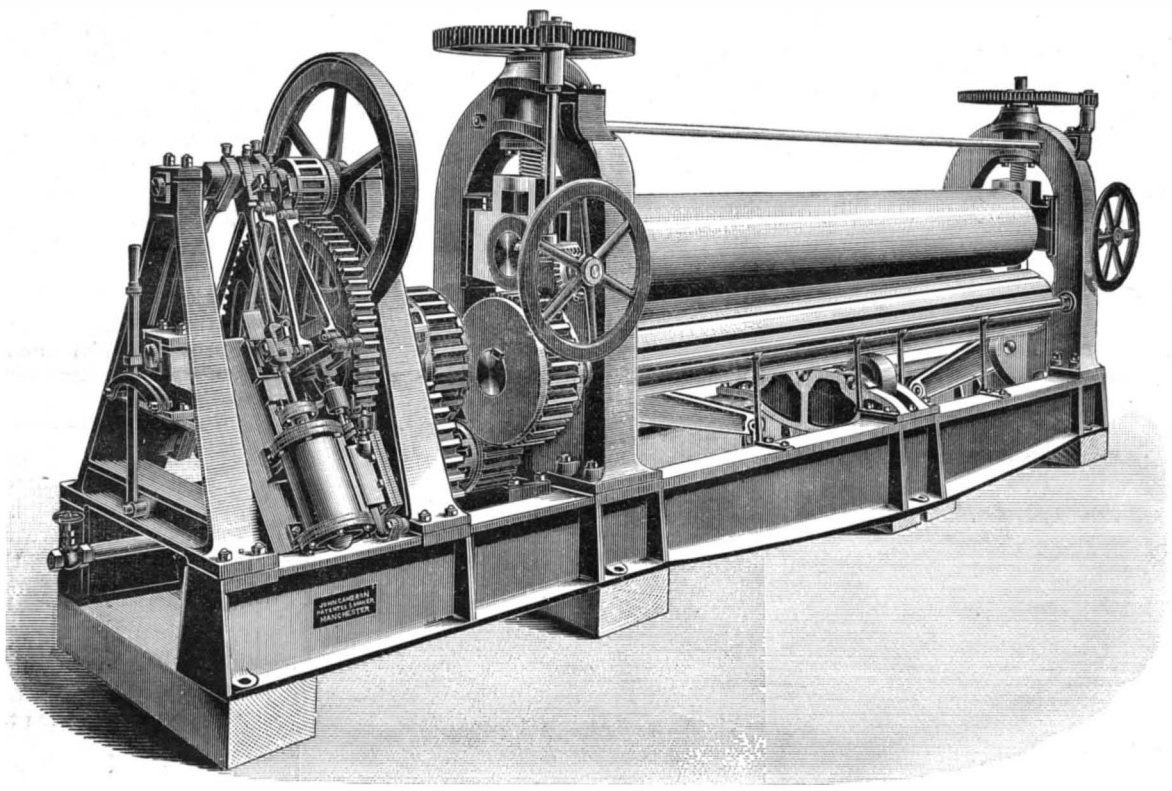
The leverage is about 4 to 1, so that with a weight of about one ton in each pan the roll will be practically b a l a n c e d. The hand gear for raising the roll is shown in the illustration. We found on trial that it was comparatively easy to lift the roll, even with the balance weights removed, but the effort would be too great to expect of a workman continuously.

The upper roll neck is 10½ in. diameter, and the two lower ones 8½ in. A special feature of this machine is the manner of supporting the rolls in the center by means of three small friction pulleys; these are situated on a strong bridge bolted across the foundation frames of the machine, the latter being deepened in the center, as shown, to take up the strain thus brought upon them. The end frames are of box section 12 in. square, and are braced together near the top by a strong bolt in the center. We may mention that the friction rollers are 12 in. diameter and 6 in. wide, having bearings on each side 4 in. diameter and 6 in. long.

There are also provided, for the purpose of supporting the plates under operation, two strong rods running from end to end of the machine, one on each side of the lower rolls; these rods are themselves supported by four vertical brackets rising from the foundation beams, so as to prevent bending.

The bed frames are extended beyond the machine proper, as shown on the left side of the engraving, and serve as a foundation for the engine; this plan makes the machine self-contained, and much more rigid than would be the case with separate foundations for the engine and rolls.

The engine has two cylinders arranged diagonally 8 in. diameter and 10 in. stroke, with pistons runnin



AN 18 FT. 6 IN. PLATE BENDING MACHINE.

at a speed of 300 ft. per minute, this speed being reduced by triple gearing to a speed of nearly five revolutions per minute of the rolls, or more accurately a circumferential velocity of 24 feet per minute. The gearing is exceptionally strong, the three pairs of wheels being 2 in., 3 in., and 4 in. pitch, and 4 in., 6 in., and 8 in. wide respectively; each of the three pinions is shrouded to the top of the tooth. From the last shaft in the above series each of the lower rolls is driven through a pair of wheels of 20 and 21 teeth respectively, shrouded to the pitch line.

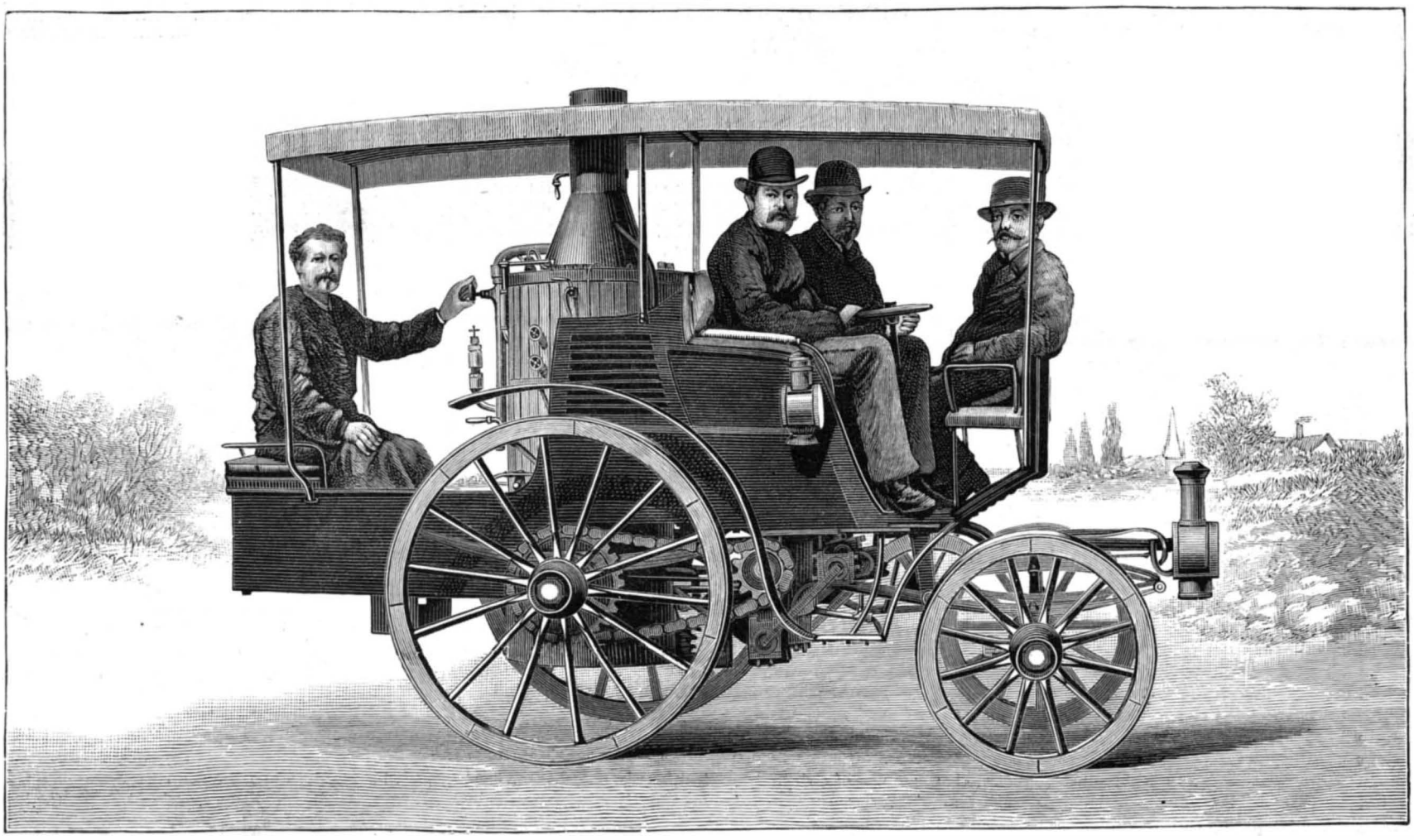
Both rolls are driven from the same end, so that all the gearing is located in the same place, and secures the additional advantage of not having the same amount of vibration and jerking as is experienced when the rolls are driven from opposite ends by means of a long shaft traversing the length of the machine.—*Mech. World.*

A NEW STEAM CARRIAGE.

Street locomotion by steam has just made a great stride in the domain of practice. Hitherto, we have been accustomed to see heavy locomotives, weighing several thousand pounds, hauling carriages at a speed much less than that of the horse, and resembling road-rollers for crushing stones more than anything else. Now, Messrs. Dion, Bouton & Trepardoux have succeeded in manufacturing steam vehicles of all sorts and of all dimensions, from the tricycle up to the largest omnibuses and merchandise vans. This result is the outcome of their quick-vaporizing, circulatory, inexplosive boiler, which is applicable to all the industries in general, and which, although of slight bulk and weight, furnishes great power. Our engraving represents one of their steam phaetons—a vehicle of remarkable elegance, lightness, and strength. The frame of the apparatus is mounted upon four wheels. The two steering wheels in front are 2½ feet in diameter, and the two driving wheels 3¾ feet. Upon the frame, and in front of the driving wheels, are placed the box and two movable seats, back to back, capable of accommodating six persons. Over the driving wheels is the boiler, and, under the seat, the water tank. Behind the boiler are placed the coal bunkers, the feed apparatus, and the stoker's seat. Beneath the frame are arranged the cylinders, and the differential gear that renders the driving wheels inter- and independent. The passenger to the right has within reach the steering and reversing levers, and can therewith steer, run the carriage backward or forward, and quicken or slacken its speed. The front platform is capable of serving as a support for a trunk or any other baggage. The carriage carries sufficient water for a run of twenty-four miles and enough coal for one of sixty miles.

The waste steam is dried before making its exit into the atmosphere, and is thus absolutely colorless. The carriage is capable of turning in a curve of 6½ feet radius. The boiler, which is 2¾ feet in height, has a heating surface of 58 square feet, and weighs, with its ash-box, its chimney, and all its accessories, 880 pounds. It takes no longer than ten or fifteen minutes after firing, to get up a pressure. The production is 14 pounds of dry steam per square foot, and 8 pounds of steam per pound of fuel.

The generator is of welded boiler plate without rivets, and is capable of withstanding the strongest shocks without its tightness being affected. It is tested to 44 pounds, and registered at 26. The engine con-



A NEW STEAM CARRIAGE.

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sists of two oscillating cylinders of 4 inches diameter and 4 inches stroke, the distribution of steam in which permits of a reversal of direction and of a variable expansion. These parts are not visible, since they are inclosed in order to protect them against dust and all other causes of deterioration.

The speed of the carriage is 18 miles per hour. It is capable of ascending gradients of one-tenth at a speed of 4¾ miles per hour. The amount of fuel consumed is from 2¼ to 3¼ pounds per hour. The smokestack emits neither smoke nor steam. The exhaust steam from the cylinder makes no noise. The wheels make a little more noise than do those of other carriages, on account of the speed of the carriage, and its weight, which, in running order, with six passengers and a stoker, is 3,960 pounds.—*L'Illustration and La Nature.*

THE LAYTON ART GALLERY, MILWAUKEE, WISCONSIN.

We give a perspective view, ground plan, and transverse section of the art gallery now in course of erection at the corner of Jefferson and Mason Streets, Milwaukee. The building is being erected at the sole expense of Mr. Fred Layton, a local art lover and successful merchant, who intends, on its completion, to present it to the city. So says the London *Building News*, to which we are indebted for our illustration. The ground or principal floor comprises three picture galleries, opening conveniently from a central apartment, and connected together by wide doors. These and the central gallery, to be devoted to statuary, are lighted by skylights of ample dimensions. On this floor are a curator's room, retiring and cloak room, and lavatories, all conveniently situated near the entrance hall. In the basement are two large rooms and an unpacking room, and extensive arrangements are provided for the heating and ventilating, a matter of the first importance in a climate such as that of Wisconsin. The exterior of the building is being constructed of the best quality of buff Amherst sandstone, straw colored Milwaukee pressed brick, and terra cotta of a similar tint manufactured by Messrs. True, Brunkhorst & Co., of Chicago. Granite, plain and polished, will be used for steps, and certain other portions liable to wear and injury. The roofing will be of tin plate, laid on terra cotta roofing plates, supported by T iron rafters. This class of covering has been found to stand best in the neighborhood of Milwaukee under all extremes of temperature. The architects engaged on the work are Messrs. W. and G. Audsley, FF.R.I.B.A., London, and Mr. E. T. Mix, of Milwaukee.

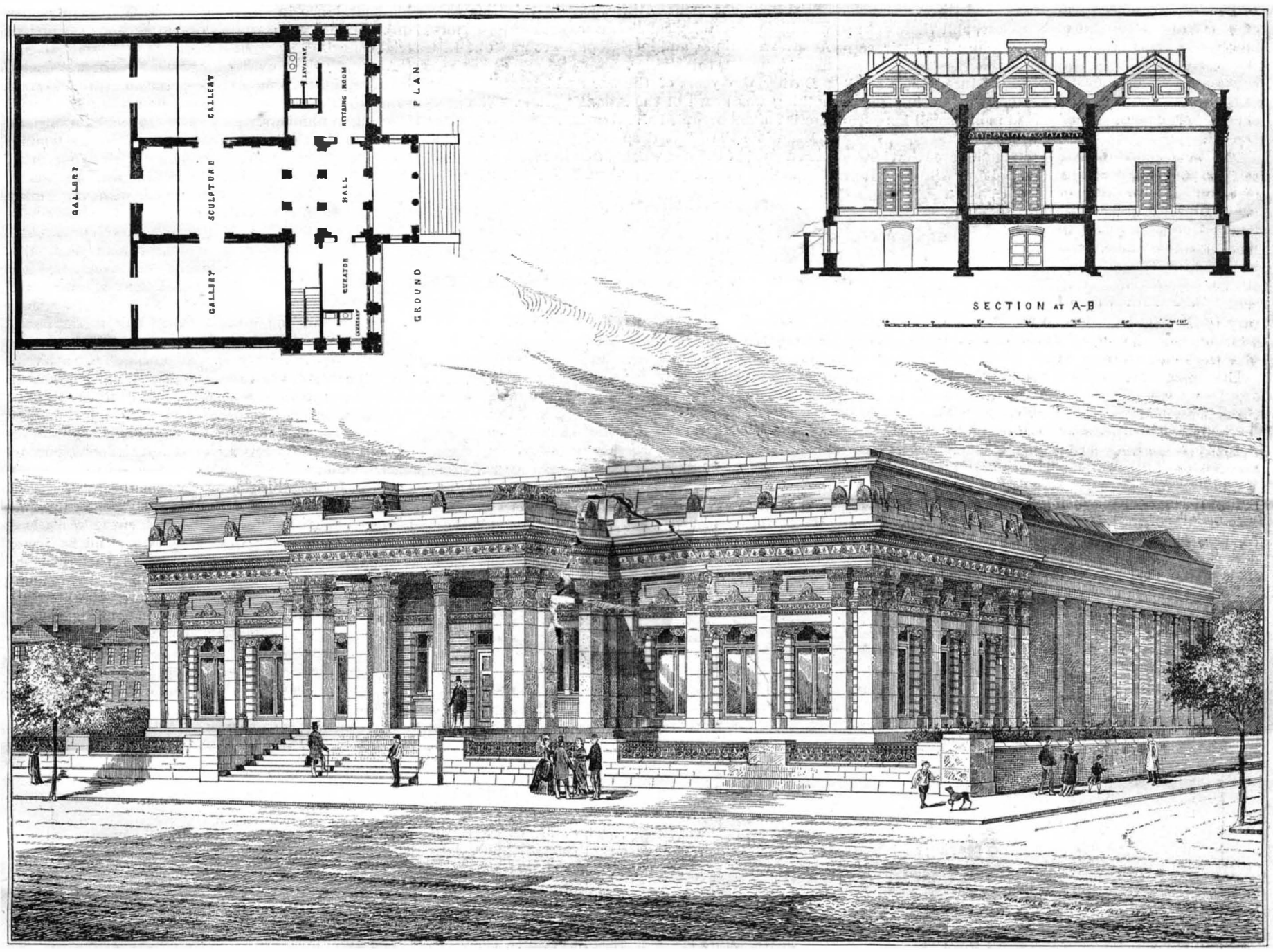
The Largest Elevator in the World.

Says a Northwestern contemporary of late date: Wheat is now pouring into Minneapolis at the rate of 300 to 500 cars per day; and to those who are not acquainted with the facilities for handling the enormous quantity of grain, the problem of what becomes of it all is mysterious and interesting. The double rows of big mills alongside the falls are greedy monsters, and at this time there are daily poured down their hungry throats about 225 car loads, or 130,000 bushels, of wheat. While a portion of the wheat, on arriving from the country, is sent directly to the mills, the bulk of it has to be first stowed in the elevators to be cleaned and prepared for milling, and afterward drawn upon as occasion requires.

A description of the method of handling wheat in an elevator is interesting. The erection of the Union Elevator at Minneapolis Junction, on the Manitoba road, this year, gives to Minneapolis the distinction of possessing the largest grain elevator in the United States, and, its owners claim, the largest in the world. No other building in the city attracts so much attention as this large house, whose gray corrugated walls loom up against the clouds like a mountain. The cities of New York and Chicago have a number of groups of buildings under the name of one storehouse whose combined capacity is greater than the Union, but no other independent building in the United States equals it in size and capacity. The total cost of the building is $300,000. It is 336 feet long, 92 feet wide, and 175 feet high. Its actual storage capacity is 2,000,000 bushels. There was used in its construction 6,500,000 feet of lumber, and thirty-two car loads, or 10,000 kegs, of big nails were required to hold the planks together. Mr. Cook, the enthusiastic young foreman in charge of the building, says the actual number of nails was 13,353,900, although he declined to say that he had counted them. A giant Corliss engine, of 450 horse power, moves the machinery, and its steady strokes are almost noiseless. The elevating capacity is 175,000 bushels per day, but this can be increased to 250,000 bushels on a pinch. The proprietors say that they can handle the entire crop of Minnesota and Dakota during the season. On every floor of the building are automatic sprinklers, which deluge the place in case of fire. As an extra precaution, 800 feet of 2½ inch fire hose and eighteen fire extinguishers are stored in handy places about the building.

An elevator is simply a mechanical contrivance for lifting grain from the ground to the upper floor. Two railroad tracks run through the Union Elevator, and the trains of cars are taken in at one end and pushed out empty at the other. When a train arrives at the elevator, the cars are backed up to the entrance, a rope is attached, and they are drawn into the building. The doors of a car are opened, and two men with shovels as large as road scrapers drag the grain into a deep pit.

These shovels are drawn by chains worked by machinery, the men guiding them in their course from the ends of the car to the door at the side. The average time for unloading a car is five minutes, and nine cars can be emptied at one time. One hundred and forty-five cars were easily unloaded in ten hours last week.



THE LAYTON ART GALLERY, MILWAUKEE, WIS.

The Union was built by Minneapolis men under the title of the Union Elevator Company, at the solicitation of President Hill, of the Manitoba road, in order to relieve the tremendous pressure on the rolling stock of his road, and facilitate the movement of the constantly increasing crops. Ex-Governor John S. Pillsbury is president of the company, and Horace Pratt vice-president.

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WHALES AND WHALING.

BY J. B. HOLDER.

Time was in our memory when whales were out of fashion, but whales and the whale fishery are more familiar subjects to-day than they have been any time in these forty years past. Why is this? Two very good reasons occur to us: the reappearance of a once very common right whale that was well nigh extinct, and the increased demand for whalebone and oil.

The discovery of mineral oil promised at one time to leave whale oil quite an undesirable commodity; but by pressure of the unnumbered wants attendant on the marvelous strides of civilization, this product has again assumed a commercial value.

The story of the whale fishery is an interesting one, and through certain circumstances is one little understood.

Prior to the American Revolution, and as far back as our history reaches, a species of right whale was indigenous to the temperate Atlantic Ocean. The earliest white settlers in New England found the aborigines hunting right whales off the shore. A canoe with two or more individuals constituted the whaling outfit; the great creatures being towed to shore, and there cut up for the various purposes then calling for their capture.

The whites, of course, early introduced their small vessels and improved apparatus; yet during many years the whale fishery consisted in but small improvement on the Indian methods.

It was not until the whales became scarce that larger vessels and a more elaborate outfit were in use. It is now that the New England people, as an old writer has it, "began to whale out in the deep sea."

This right whale, called by the early authors the "second sorte," in contradistinction to the large Arctic whale, is first mentioned A.D. 890, in "Orosius Voyages," written by Alfred the Great.

In the twelfth century an old Icelandic clergyman published in Konigspeil ("Mirror of Royalty") a list of cetaceans, in which he enumerates a "second species, called Nordcape, from it having been seen first off the North Cape of Iceland." Other writers mention this whale under the name Sarde and Sletbag, the latter meaning a whale without a dorsal fin—the finback probably being familiar to the peoples of that day, as it is now.

The earliest English record of this whale seems to be that of John Smith, in "Annals of Salem, Mass." He says: "The whaling business began on the New England coast prior to 1614, guaranteed by royal authority to Mass. Bay." The same author states that in 1690 "whales were occasionally killed in Cape Cod Harbor. Nantucket first sent boats this year from shore, and in 1700 they began to fit out small vessels. In 1714 small vessels were sent to Newfoundland, and southward along the gulf. In 1748 whales became so scarce that they were pursued in larger vessels, an hundred sails being fitted out from Boston." The whale thus pursued was the Atlantic right whale, not the finback, which was not regarded as worth capturing as long as there were any right whales within reasonable distance.

It was on the account of the finback being undesirable in these early days that the larger baleen whale was called right whale, as it was the right one to search for; the latter giving much more oil and valuable baleen, or whalebone. The finback has very narrow, short, and coarse baleen.

New Bedford commenced the business of whaling in 1755, their boats going as far south as the capes of Virginia.

In 1770 these temperate Atlantic whales became so scarce the vessels employed were built for long voyages, across the Atlantic.

This right whale was first hunted by the Basques, a colony of fishermen on the coast of the Bay of Biscay, who had from early times pursued this occupation. As the whales became less numerous the voyages were extended, until the great Arctic whale, which is essentially confined to the waters of the Arctic zone, was accidentally met with. Seafaring people are not always acutely observing of characters of marine creatures that do not concern their occupation; consequently no one chanced to discover that they had come upon a different species of whale entirely. Nor did they care, especially as the new one proved to be much more valuable, having "whalebone" of very much greater size, and, of course, more value, and superior oil, in quality and thickness—the northern sea creatures evidently requiring heavier layers of fat.

This state of things continued until 1775, or about the time of the Revolution. The "second sorte" had been growing scarcer, until now it had become practically extinct. None were caught. Naturalists in Europe had some knowledge of this lost whale, that, as we have seen, was recorded by old authors, but the record was meager. It was understood by them that there was a larger species in the north, and that this was a "second sorte." So long as this "second sorte" was available, the whalemen desired nothing better; but when they became so scarce, it was necessary to push north and capture what the whalers of that day thought were no more than a larger kind.

The truth is, and this, though, as we have seen, was known vaguely to the few cetologists of the time, there are two distinct species of baleen or right whales—the great Arctic or Greenland whale, bowhead, so called by the present race of whalers (*Balæna mysticetus*); and the Atlantic right whale, nordcaper, sletbag, and sarde of the old authors, black whale of the early settlers of New England (*Balæna cisarctica* of Cope).

During the Revolution, the men usually employed in whaling were occupied in some service of the conflict. But little if any whale fishing was carried on during the several years of war. It will be borne in mind that the Atlantic right whale was nearly extinct at the commencement of this war. At this time there was little of cetological literature credited to North American authors, and in Europe there was but little more, touching this species.

During the years of the war and succeeding years nothing was heard of the Atlantic whale. The great Arctic animal occupied all attention.

Meantime the great deep held a small family, or at least a pair, of the lost whales, and in 1854 a female, accompanied by its young, visited the old "hunting grounds," the Bay of Biscay. The cub only was taken. It is a pleasing circumstance that the first appearance, after so many years, of this species should be in the waters from which the creature first derived its specific name. Eschricht named it *Balæna biscayensis*.

In 1865, Prof. Cope, of Philadelphia, examined the first nearly adult example that has come under scientific inspection. William Penn, in 1683, relates that eleven of these were taken that year, called by the whalers black whale. Prof. Cope's examination proved the identity of these with the Biscay whale, consequently the terms *cisarctica* and *biscayensis* have been applied to the same species.

So far science had not gained a full account of this lost and found whale. It had been gone so long, no one knew anything of it. To the "lay" reader it was an unknown quantity; to the cetologist it was known only as a cub, and by certain features handed down by very crude drawings and carved blocks, which, however, prove to be accurate, so far as they appear.

A little more than ten years after Prof. Cope's identification, an adult female, 48 feet in length, was captured off Montauk Point by some whalers. This was exhibited in New York Harbor in the spring of 1883. We had the privilege of examining this specimen, and through the courtesy of the owners and the captor, Captain Josh. Edwards, we made an exhaustive description of its characters, externally. The first feature noticeable, in comparison with the Arctic whale, is the shortness of the head. The latter whale has a head measuring one-third the total length. The present species has a head one-fourth the same. The baleen is not half the length of that of the Arctic species; consequently the value is much less, while the oil is much less in quantity.

Only one more specimen was known to have been seen on our coast; that was thrown ashore on Long Island about 1860. Peter Cooper secured the bones, with the baleen, and generously gave it to the American Museum of Natural History on the occasion of its founding—in 1870. A male specimen was captured in Charleston Harbor in January, 1880, after an exciting chase of several days' duration. Steam tugs were used, and several times the harpoon lines had been made fast, but the creature, which measured nearly 50 feet, struck the tugs in its furious lashings, and injured them to the extent that the whalers were obliged to resort to the old methods of whaleboats, oarsmen, harpooners, and lancemen—when the great creature was captured.

During the extremely cold weather of last January, six examples of this whale appeared off Montauk and Southampton, on Long Island. The hardy seamen and whalers of that region put out in regular trim, and captured four of them, two being young. A large one gave the old whalers a deal of trouble. During the coldest night of that notable cold "spell," Captain Edwards, who is over 60 years of age, stood at the bow of his boat, lance in hand, the icy waves beating most unkindly over him, while hour after hour of anxious trial passed.

At length the opportunity came, and the well-poised lance brought the monster cetacean to death. It now seems that the Atlantic right whale is gradually increasing in numbers.

The finback—*Balænoptera*—has long been a familiar creature off our North Atlantic shores. Systematically, it is of another family, the distinguishing features being the small head, with very insignificant baleen or whalebone, and a fleshy, fin-like member on its back. The balænopters are notably long and slender, compared with the baleen whales. The great rorqual, the largest known mammal, is of this group.

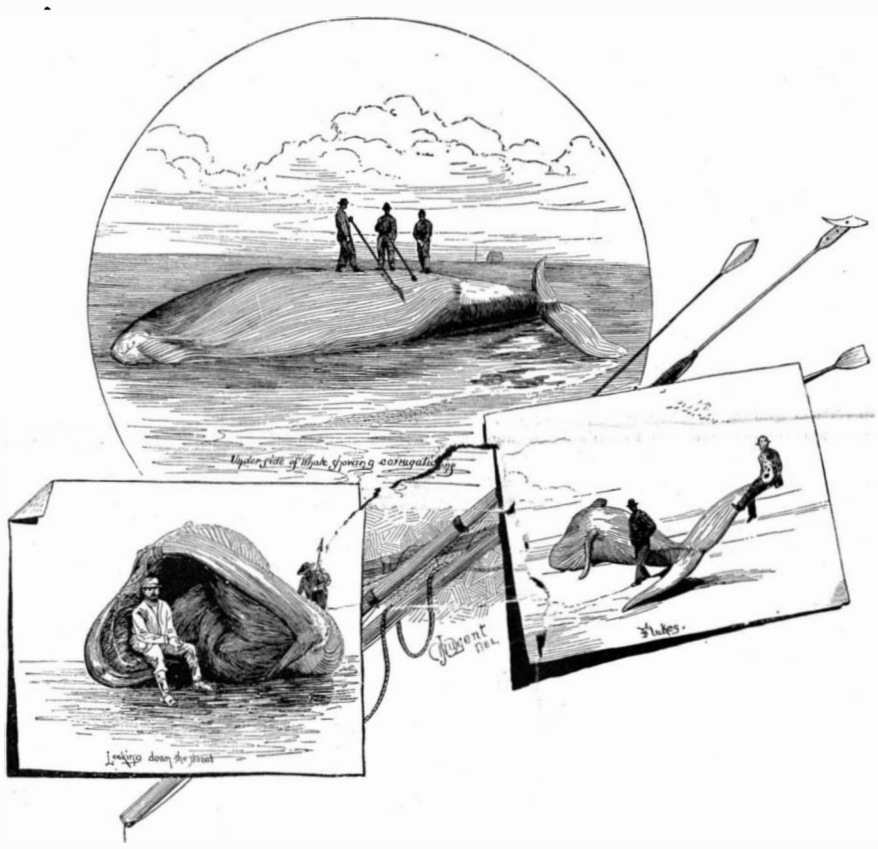
The finback is the whale so frequently seen off vessels along our coast and in mid-Atlantic. This whale is so active, it proves a dangerous enemy when once attacked and wounded, consequently it is not sought after extensively; though it were implying a lack of courage and enterprise on the part of our seamen to say this without explaining that the baleen of this whale is so small and coarse it is useless, and the fat is so meager in quantity it does not pay well.

The Cape Cod whalers and fishermen have in late years pursued them in steam tugs, and each autumn there are many captured in that manner. The blackfish (*Globiocephalus*) is the most common cetacean pursued by the Cape Cod people. It is in the habit of visiting the vicinity of Cape Cod harbors in droves, and much sport is had driving them in and beaching them.

They feed on the squid (*Octopus*), and follow the schools of that mollusk; sometimes fifty or a hundred blackfish are seen on such occasions. They swim with much of the body exposed when going rapidly, thus giving a most singular exhibition of marine maneuvering. They have a habit, like that of the sperm whale, of "standing" in water perpendicularly, with a portion of the head above water. This cetacean is equally common on both sides of the continent and the equator; and they even extend to high northern and extreme southern latitudes.

The term blackfish is misleading to those not acquainted with cetaceans. It is one of the dolphin family—related to the porpoise—but is larger. The white whale is about its size, reaching some 15 feet, though the latter is oftener about 10.

The extreme beauty of the tail and its admirable adaptation for its purposes as a propeller are well shown in the picture of the finback. The great mouth of these creatures seems out of all proportion, but the food being mostly soft marine animals, like the mollusca, going in immense schools, the creature scoops up vast quantities at once. The swallow, or œsophagus, is very small, not larger in a whale 50 feet in length than one's two fists. The great tongue is closed over the mass of jellies after they are taken in the mouth, pressing them against the roof of the mouth, when the water that has been taken in oozes through the plates of whalebone, and the morsel of food is pressed into the stomach. The great rorqual, or sulphur bottom—a Pacific species—often has reached near a hundred feet in length. Examples measuring over a hundred are recorded. Some errors are extant concerning the great Arctic whale (*Balæna*) and the sperm whale (*Physeter*). Both are equally bulky, and both about the same length. None ever reach over 60 feet in length. Their heads are, in both cases, about one-third their total length, but are much the greater bulk. The sperm whale is well known as a carnivorous cetacean, living on fishes, its lower jaw being supplied with long rows of teeth.



WHALES RECENTLY TAKEN NEAR LONG ISLAND.

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ENGINEERING INVENTIONS.

A glass tube for water gauges has been patented by Mr. Auguste Guilbert-Martin, of St. Denis, France. It has a longitudinal colored strip or strips on a white or bright strip, the colored strip being arranged nearer the inner surface of the tube than the white or bright strip, whereby the upper end of the column of liquid can be more easily distinguished.

A track and wheel cleaning and lubricating device has been patented by Mr. Francis G. Tuttle, of Portland, Ore. It is intended to be operated by the ordinary locomotive injector, combining with a pipe leading therefrom a series of pipes leading to the front and rear of the locomotive, having nozzles for discharging hot water upon the track, and jets of water upon the drive wheels.

A car truck has been patented by Mr. Arthur M. Wellington, of New York city. This invention covers a check chain so made and applied as to absolutely prevent the swiveling of the truck through a greater angle than is necessary to enable the car to pass through or over curves of such radii as are encountered in ordinary service, doing away with the coils of check chains having excessive slack.

A railway track has been patented by Mr. Jacob Frysinger, of Rock Island, Ill. The cross ties are of metal and the stringers of wood, seated in the cross ties, the fastening bolts passing through both and the rail, the bolt holes in which and in the stringers are elongated, whereby the strain of the bolts on the stringers is relieved, and the rails cannot spread unless the metal be torn apart.

A car coupling has been patented by Mr. Adrian T. Lott, of Coldwater, Miss. It comprises a drawhead with a pivoted and spring pressed coupling plate having an inclined downwardly projecting hook, allowing automatic coupling, together with a screw rod adapted to be operated from the top of the car, to tilt the coupling plate to lift its hook for uncoupling the cars.

An electric time signal for railways has been patented by Mr. George Cornell, of Crystal Run, N. Y. Combined with a clock mechanism, stationary magnets, and armature lever, are a sliding hand, weight, and studded arm, connecting the hand with a wheel of the clock mechanism, with other novel features, the device being especially designed to automatically indicate the time elapsed between trains passing the station.

A metallic piston packing has been patented by Mr. Nicholas Pflaum, of Port Jervis, N. Y. This invention covers an improvement on a former patent, and provides for such a construction that, as the outer surface wears away, the packing will always retain its circular form, and remain in close contact with the cylinder, while the interior is calculated to feed melted tallow to lubricate the inner surface of the cylinder.

A hydraulic forging machine has been patented by Mr. Charles Davy, of Sheffield, York Co., England. This invention has for its object to lessen the friction on the rams, guides, etc., from the expansion of the parts by heat from proximity to the ingot, and also to more effectually guide the moving cross head, and provide improved valves and method of working the main and lifting rams by high and low pressure water, obtaining a quick motion of the moving cross head toward and from the work.

MECHANICAL INVENTIONS.

A taper and pulley turning attachment for lathes has been patented by Mr. Thomas H. Worrall, of Meredith Village, N. H. Combined with the bed and a carriage thereon is a tool holder fitted in ways on the carriage, a lever pivoted to the carriage and to the tool holder, and a bar connected to the lever and to a fixed arm on the bed, with other novel features, whereby the tool holder is automatically shifted to turn a convex face on the rim of a pulley or to turn a bevel.

AGRICULTURAL INVENTIONS.

A cylinder plow and pulverizer has been patented by Mr. Samuel M. Neely, of Smith's Turn Out, S. C. It is so constructed as to be readily adjustable to work at any desired depth in the ground, and to pulverize the soil as fine as desired, while it automatically clears the teeth of the soil.

A sugar cane harvester has been patented by Mr. Charles H. Lee, of Centralia, Kansas. It has an endless chain of knives, two pairs of vertical shafts, and a horizontal shaft with chain wheels, with other novel features, whereby cane and sorghum can be cut and topped, and the cane or stalks deposited in wagons drawn at the side of the harvesters.

A corn planter has been patented by Mr. Edward Burkholder, of Glendale, Ky. The object of this invention is to afford such construction that the planter can be readily controlled, will adapt itself to uneven ground, and can be conveniently adjusted to plant three rows at a time, or a single row, while packing the soil upon the seed and smoothing the tops of the rows.

MISCELLANEOUS INVENTIONS.

Suspenders for men's trousers form the subject of a patent issued to Mr. George H. Boyd, of Marysville, Cal. They are so made as to be attached to the waistband at the front and sides only, and do not interfere with stooping and bending, so the suspenders and buttons are not subjected to undue strains.

An envelope has been patented by Mr. Samuel H. Smith, of New York city. It has two checks on its flap, and a gum line on the back of the flap above the checks, with a gum line at one end, being designed for keeping money or valuables, and also to serve as a receipt for one with whom it has been left.

A combined truss and supporter has been patented by Mr. Henry A. Schulz, of Brooklyn, N. Y. It unites a rupture pad and an abdominal supporter in such a manner as to relieve the rupture pad from the abdominal weight, and thus allow it to do its work effectually while exerting a light pressure.

A hot air fireplace has been patented by Mr. Doyel Pearson, of Memphis, Tenn. This invention covers a novel construction and combination of parts for open fireplaces where wood is burned, to save waste heat and conduct the heated air where it is wanted, or more effectually diffuse it throughout a room.

A water tank has been patented by Mr. Francis J. Kearney, of New York city. It consists of two independent compartments, one within another, with space between them, and suitable inlet and exit valves and overflow pipe, the whole making a novel construction of a safety tank.

A swing has been patented by Mr. William S. Brown, of Pine Hill, Ky. Combined with front and rear swinging rods and seat bars are pivoted levers, whereby in swinging the seat is always kept level, and when the swing is once in motion but little power is required to operate it.

A rotary escape movement has been patented by Mr. William D. Chapman, of Theresa, N. Y. This invention covers a novel mechanism adapted to effectively give reciprocating motion to a column carrying articles in showcases, or to perpendicular and horizontal movements in clocks, watches, etc.

A window curtain has been patented by Mr. Frederick H. Goodyer, of Nottingham, Eng. It has an extension at one end, festooned from side to side to form a lambrequin, the latter being made in one continuous piece with the curtain, and there being a continuous border extended around both the curtain and lambrequin.

A check hook has been patented by Mr. Neil McGoldrick, of Brooklyn, N. Y. This invention covers an improvement on an another recent patent, and provides for a construction by which the horse may be unchecked and checked up again from the vehicle, without stopping the horse and without getting out of the vehicle.

A filter has been patented by Mr. William L. Johnson, of Hackettstown, N. J. This invention relates to covered overflows and double filters connected with reservoirs, and the construction is such that the overflow may be arranged to prevent, in time of high water, muddy and impure water from entering the filters and reservoir.

A nut lock has been patented by Mr. James B. Law, of Darlington, S. C. The nut has an unslitted end extension of reduced thickness, with a thread corresponding to and communicating with the thread of the nut proper, formed of malleable metal and compressed into an elliptical cross section shape, so the nut itself furnishes the lock.

A bottle washing apparatus has been patented by Mr. Alfred L. Bernardin, of Evansville, Ind. The leading feature of this invention is the projection of shot upward into the bottles, with a discharge of water, the shot being projected by plungers that work in vertical guides, and forced upward by spring hammers actuated intermittently by suitable mechanism.

A churn dasher has been patented by Mr. John B. Swaim, of Newbern, Ind. It has an annular base plate and circular top plate, inclined slats connecting them, with a handle having a conical knob on its lower end secured in a hole in the top plate by a key in such manner that the dashers may be easily moved through the milk and quickly bring the butter.

A reservoir window washing brush has been patented by Mr. Thomas McCabe, of St. Joseph, Mo. Combined with a brush having holes at the top to admit water to the bristles is a reservoir of water hinged to the top of the brush, with tubes to feed the water through the holes, the supply of water following the brush when in operation on a window.

A lath attachment has been patented by Mr. Edward J. Bracken, of Columbus, O. It consists of a wire and fastening plate device for stiffening the lathing or joining the ends of the lath, so that it will not be necessary to uniformly space the joists of a building, and the lath need not be of uniform or regular lengths.

An ice plow has been patented by Messrs. John G. and Henry Bodenstein, of Staatsburg, N. Y. Its frame consists of two bars or plates of unequal width, with their forward ends curved or bent upward, and provision is made for the escape of chips when the plow is working at its full depth, the frame being permitted to pass over projections.

An automatic flushing water closet has been patented by Mr. William B. Parsons, Jr., of Elmira, N. Y. This invention covers a trough formed with a series of basins located on different levels, each basin having a weir or dam, in combination with a flushing attachment, all corners of the trough being rounded or sloped.

A self-holding screw driver has been patented by Mr. John W. Richardson, of Park City, Utah Ter. It has an outer casing in which is held by pins a skeleton piece and ring with an inner shell and jaws for holding the screw to be inserted, so that the screw may be placed, started, and driven home without using the hands and without starting with a hammer.

A churn has been patented by Messrs. Henry Brown and Andrew Bushnell, of Lamar, Mo. It consists of a peculiar form of agitating and butter gathering frame, with a top ring and ribbed sides dependent therefrom, with plates connected therewith, to provide for the rapid making and separating of the butter and easy cleaning of the parts of the churn.

A water gauge has been patented by Mr. William Young, of Easton, Pa. It has two concentric glass tubes, with a space between them, the inner one communicating with the steam passages, with stuffing boxes for securing the inner tube to the elbows, whereby sudden changes of temperature will not break the glass tube.

A combined galley rest, copy holder, and copy guide for the use of printers has been patented by Mr. Joseph Silbernik, of New York city. It is so made as to be readily applied to the lower case to hold a galley, when correcting proof, and to the upper case for holding copy, without obstructing any of the compartments of the case.

A refrigerator has been patented by Mr. John Falkner, of Orange, N. J. It is a peculiarly constructed ice box and provision chamber, with communicating openings arranged to be closed by the lids to the provision chamber when the latter is opened, and *vice versa*, thus effecting economy in the consumption of ice and rendering the refrigerator very convenient.

A fastening for double doors has been patented by Mr. George W. Wright, of Leavenworth, Ind. It is a combination and arrangement of bolts and a guiding plate on one door, operated by levers, rack, and pinion, with devices for locking the levers when the doors are closed or opened, and so that the bolts of one door will lock or unlock the bolts of the other door.

A suspender strap clasp has been patented by Mr. Charles R. Harris, of Jersey Shore, Pa. It is formed of a metal plate bent upon itself to make the front and rear portions, having prongs and slots to receive them, and inwardly projecting teeth, making a strong, neat clasp, more securely fastening the straps than the common leather loop.

A lumber measurer has been patented by Mr. Emmet N. Barber, of Kent, Ohio. It is a device that can be set for boards of different lengths, measuring them by being rolled across them, and registering the measure accurately and rapidly, being also adapted for making different registrations of different grades of lumber.

A sight for firearms has been patented by Mr. Walter G. Owen, of New York city. It is a sight bar with its ends similarly shaped, but having contrasting colors, mounted on a plate adapted to be rotated on a base plate, with stops for limiting its movement, making a sight for use in dark or cloudy as well as fine weather, and in the night.

An automatic dam has been patented by Mr. Horace Harding, of Tuscaloosa, Ala. It is designed for maintaining navigation when the water of a river is low by automatically making slack water levels, stopping the water when it is running low, and automatically removing the dam to permit the passage of boats when the water is running high.

A tidal power mechanism has been patented by Messrs. Felix R. Bussard and Martin Gates, of Hays City, Kan. It consists in a float supported by the water, carrying a rack bar which engages gearing for winding weights by the rise and fall of the float, thus storing power in the weights to be given out gradually in doing work.

A lock has been patented by Mr. John C. Taylor, of Niles, Mich. It may be adjusted as a latch to allow the door to be opened from both sides without using the key, or to unlock the door from the outside with the key, or to prevent the unlocking of the door with the key, its construction being simple, inexpensive, and durable.

A sand moulding machine has been patented by Mr. Patrick C. Smith, of Indianapolis, Ind. It has gear wheels operated by a lever and meshing into racks which carry the follower plate, with adjustable pins and a device for regulating the depth of the mould, making a device in which the patterns can be easily changed and adjusted to suit the different forms and sizes of the work.

A churn has been patented by Mr. Loren J. Wicks, of Paterson, N. J. It has a vertical central shaft, which by a bevel cog wheel and pinion is revolved in the cream, carrying blades and wheels to agitate it thoroughly, while an air tube also extends down the center, carrying a flattened nozzle, which is made to revolve near the bottom of the churn, and draw air down into the cream.

A door latch has been patented by Mr. William G. Cline, of Gallatin, Mo. Combined with a latch casing is a knob bolt with notches in its head, a sliding latch with a lug on the inner end and the front end projecting from the face of the door, the projecting end being made adjustable, so the bevel of the head does not strike the edge of the keeper, and the bolt is withdrawn as long as the door is open.

A thread waxing and heating device for sewing machines has been patented by Mr. Benjamin F. Landis, of St. Joseph, Mo. It provides means whereby the upper thread may be waxed during its passage from the tension to the needle, and be shielded from cold, taking a direct course from the tension device through the waxing device to the delivery stud near the needle.

A fastener for hand satchels has been patented by Mr. Max Rubin, of Brooklyn, N. Y. Combined with the frame is a projecting slotted plate attached to one part of the frame, a projecting post with rounded end being attached to the other part of the frame, and engaging with the slotted plate, the device being simple in construction, and holding the frames securely closed.

A spring for velocipede seats has been patented by Mr. Robert E. Humphreys, of Irwin, Pa. The spring support is formed of a wire bent to have coils at the front and rear of the support, the coils being in horizontal planes both at the front and rear, and the top and bottom coils alternating both at the front and rear, the support accommodating a saddle of the usual construction.

A lowering mechanism for dentists' chairs has been patented by Mr. Levi Stuck, of Hart, Mich. Combined with uprights is a tapered sliding bar, with clamping plates at its sides, and screws acting thereon, with a lever to which the screws are atttached, and various other novel features, whereby the chair may be easily raised and lowered, and locked at any desired height.

A rotary pump has been patented by Mr. Joseph F. Breux, of Philadelphia, Pa. Within the casing is a cylindrical shaped casting, to the outer surface of which are hinged three pistons that revolve in recesses in the sides of the outer casing, while there are various novel features of construction intended to lessen friction, and render the action of the pump simple and effective.

A washing machine has been patented by Mr. George G. Koschel, of Denver, Col. Combined with a clothes box and devices for washing the clothes therein, is a sliding box held under the clothes box, and having hinged side and end pieces, while being provided with legs, the clothes being cleansed by being whirled about in the tub, and the machine being provided with a wringer.

A snow shovel has been patented by Mr. David Flack, Jr., of Toronto, Ont., Canada. It is of wood, with a metallic edge, slightly curved backward to prevent its engaging with obstructions, and has a handle hinged to the under surface of the shovel, near the center, with a fastener for holding the handle when folded against the body, with other novel features, the shovel being easily changed into a scraper.

An extension table has been patented by Mr. Siegfried E. Claussen, of Portland, Oregon. It has a roller section with a metallic frame having arms, a cross bar connecting the inner ends of the arms, a roller journaled in the arms, with extension slides joined together, forming a series or chain, connected at one end with the slide section and at its other end with the cross bar of the roller supporting frame.

A saw sharpening machine has been patented by Mr. David W. Johns, of New Albany, Ind. It has a rotary file or cutter with a notch in its edge, a plate being held at one end on the disk and extending diagonally across the recess, with a screw for adjusting the pitch of the plate, and various other novel features, the device being adapted for sharpening saws of all kinds, either straight or circular.

A dyestuff made from diazo-naphthaline has been patented by Mr. Meinhard Hoffman, of Mainkur, near Frankfort-on-the-Main, Germany. It is a new gammadisulphonic acid of betanaphthol, whose manner of preparation has been the subject of a recent patent; it is characterized by its great tendency to crystallize, and is adapted for dyeing wool, silk, and other materials a brilliant bluish-red shade.

A hydraulic elevator has been patented by Mr. Parker F. Morey, of Portland, Oregon. It comprises a main standpipe connected with water distributing inlet and outlet valves, a telescoping ram in the standpipe having an opening and a long tapering inlet valve, to open as the ram rises, with other novel features, to insure a practically uniform steadiness of movement of the platform or carriage both ways.

A thread breaking attachment for doubling and twisting machines has been patented by Mr. Fred Haggas, of New York city The invention consists of a special construction of the yarn holding plate or head, and the parts connected therewith, to sever both yarns in case one of the yarns breaks or one bobbin runs out sooner than the other, thus preventing waste and the formation of three or four ply yarn.

Transfer or reproducing paper forms the subject of a patent issued to Mr. David Gestetner, of London, Eng. The paper is of bamboo fiber, on one surface of which a layer of wax or paraffine is fixed, the paper being perforated with a stylus or toothed wheel to produce the desired letters or design, when, on passing an inked roller over it, the ink passes through the perforations upon the sheet below.

A wagon body has been patented by Messrs. James B. Law and Charles Mooney, of Darlington, S. C. It is of simple construction for holding the side boards and tail gate keeper firmly, avoiding all bolt or screw holes in the side boards, double armed clamps being used, and the design such that the body may be readily taken to pieces and packed for transportation.

A toy spring gun has been patented by Mr. Francis W. Goodyear, of Springfield, Mass. The barrel has a longitudinal groove in its top, the trigger is pivoted in a slot in the barrel, with its upper end projecting slightly from the groove and the lower end connected by a wire with a trigger lever pivoted in the stock, the gun being adapted to throw a dart or arrow by an elastic band or cord.

A buggy top has been patented by Messrs. Edward Carroll and Patrick Ryan, of Guelph, Ontario, Canada. Combined with the seat box are side arms and a top supporting frame pivoted to each side, between the sides of the box and the arms, whereby the top may be swung to one side for people to enter or leave the vehicle without obstruction from the bows or frame.

The embossing of plastic material forms the subject of a patent issued to Mr. Charles Schwartz, of Brooklyn, N. Y. The invention relates especially to embossing paper, and preventing the surface of the raised portion from cracking, for which the outlines of the letters or figures to be embossed are incised on the upper surface, so that when a sheet or card is submitted to pressure between the dies, the stretching of the fibers will not break or tear the surfaces.

A glove fastening has been patented by Messrs. Augustus Travers, of New York city, and Henry B. Pierson, of Brooklyn, N. Y. The edges of one flap have holes, with open spring rings held along their edges by threads, and ball headed studs are held on the edges of the other flap, so that the glove can be fastened by drawing the flaps together and pressing the ball headed studs through the spring bound holes, or it can be opened.

A machine for testing lubricants has been patented by Mr. Robert H. Thurston, of Ithaca, N. Y. This invention covers an improvement on a former patented invention of the same inventor, whereby the testing journal was made removable from the shaft, etc., and provides for making the bearing with a thin removable shell, so light that it can be taken out and weighed with great accuracy, the journal also having an outer and comparatively thin shell that can be removed for accurate weighing.

A printer's chase has been patented by Mr. Lauriston W. Hardwicke, of East Saginaw, Mich. It has long screws held adjacent to and parallel with the inner edges of a chase, with movable longitudinal and transverse bars having apertures in the ends through which the screws are passed, with nuts on the screws adjacent to the outer edges of the bars, so the latter may be moved up thereby on the screw in the direction of the length or width of the chase with a simple key.

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Business and Personal.

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Patent Office "Official Gazette;" full sheep binding; 1881 to 1885 for sale. "Cheap," 51 John St., N. Y.

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The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

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Timber Gaining Machine. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Curtis Pressure Regulator and Steam Trap. See p. 350.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

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Providence Steam Engine Co., Providence, R. I., are *sole builders* of the "Improved Greene Engine."

Domestic Electricity. Describing all the recent inventions. Illustrated. Price, $3.00. E. & F. N. Spon, New York.

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NEW BOOKS AND PUBLICATIONS.

THE MAGAZINE OF AMERICAN HISTORY. Edited by Mrs. Martha J. Lamb. New York: 30 Lafayette Place.

This monthly journal of history upholds the high standard by which it has been marked from its inception, and which was characteristic of all of Mrs. Lamb's preceding work. Its articles are all valuable, evincing sound judgment in the selection of subjects and faithful original research in their elucidation, while there is sufficient variety in the matter to render each number exceedingly interesting to a very wide range of readers. The frontispiece of the December number was a portrait of the late General McClellan, which is accompanied by an appreciative sketch by the editor. The series of articles on our "Historic Homes" is continued, with an illustration of the Brooklyn house of Philip Livingston, one of the signers of the Declaration of Independence, on what is now known as Brooklyn Heights; while there is a valuable article relative to the Massachusetts Constitutional Convention of 1788, a chapter on the Mexican war, and two contributions relative to our late civil war. The January number contains a steel plate engraving of General John A. Logan and a number of wood engravings illustrating incidents in our late war.

LONGITUDE BY LUNAR DISTANCES. By Major H. Wilberforce Clarke. London: W. H. Allen & Co., 1885.

Major Clarke has offered in this volume a method of calculating longitude by lunar distances in which the calculation is simplified by a division into several distinct steps, and is so presented that even the inexperienced traveler can, with a little patience, fix his position upon the earth's surface with precision. The moon has a daily motion among the stars of about 13°. The geocentric angles between the moon's center and certain of the stars and planets are given in the *Nautical Almanac* for every three hours of Greenwich mean time. If at any place the distance between the moon and one of these bodies be determined with a sextant or reflecting circle, and be corrected for semi-diameter, refraction, parallax, and spheroidicity, the geocentric lunar distance will be obtained; and this, when compared with the distance recorded in the Almanac, will give the longitude of the place. But this apparently simple calculation is decidedly difficult, and apt to deter one from making the effort, unless he be aided by some such systematic method as Major Clarke has suggested.

Golden Text Calendar. Selections from the best authors, and International Sunday School Lesson Text for each Sunday. By Mrs. A. C. Morrow. $1.00. D. Lothrop & Co., Boston.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest, cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Minerals sent for examination should be distinctly marked or labeled.

(1) W. M. B. asks (1) if pine sawdust can be put to any profitable use. I have heard it could be mixed with pitch or resin, and moulded in brick for fuel. I am in the back woods, where several sawmills saw long-leaf pine, and the dust is thrown away. I wish to know what are the best steps to take to make it profitable and put upon the market? A. You can mix your sawdust with a little pitch or resin and mould it into bricks under pressure, to be used for kindling wood, but we doubt if you could make it profitable, on account of the expense of transportation. The sawdust may also be used in the manufacture of pyroligneous acid. 2. I have a lot of black walnut shells I wish to use in making walnut stain without use of water, as, when walnut stain becomes too thick or dark, it is thinned by adding turpentine. Turpentine and water won't mix. Please tell me what to do in this matter. A. Try dissolving out the coloring matter with alcohol or turpentine. 3. I wish to construct some cheap and convenient plan to use steam from a 20 horse steam boiler for steaming plank so as to bend easily for coffin sides. Please tell me how this process is done. A. An ordinary wooden tank or box arranged to use the exhaust steam from your engine will answer your purpose. Care should be taken that the steam pressure does not exceed the resisting power of the box. You will need to steam your plank for three or four hours before bending.

(2) F. S. asks the proper way to make a joint in a street main cast-iron water pipe; the proper material for piping leading from the main to the house; the proper depth to lay a main in a street; and whether there is any device for drilling, tapping, and connecting a pipe while main is under pressure? A. Lead is the only proper material for joints of street main pipes—a gasket of hemp being first driven into the bottom of the socket to keep the lead from leaking into the pipe. Then put a putty closure around the mouth of the socket, held to place by a rope, wood, or packed sand, with a hole at top to pour in the lead. When poured and cool, drive the lead in hard with calking tools. The leaders to houses should be lead or galvanized iron pipe. The connection with the main should be a brass drive cock, or may be made with a screw joint. The proper depth for mains in your State should be at the mid-winter frost line, probably seven feet. There are devices for drilling and driving or tapping under pressure. They may be obtained through the plumbing trade.

(3) W. W. W. asks: What is a good dip for cleaning brass patterns? A. They should not be dipped in any acid. Use only a soft brush dry, or wash with hot water, soap, and brush. This is the practice in the best malleable iron foundries.

(4) J. D.—You cannot practically operate a siphon more than 25 feet above the source of supply. All water contains air, which is liberated under partial vacuum, and will stay in the top of the siphon and break the flow. The plan that you have sketched is not practicable.

(5) O. N. L. asks: What preparation of glue is most suitable for facing cast iron pulleys? A. Glue, 1 quart, dissolved in cider vinegar; add 1 ounce Venice turpentine; boil gently for 12 hours. If the pulley has been used and is smooth, scratch the surface with a file.

(6) S. N. P.—For the galvanizing process see SCIENTIFIC AMERICAN SUPPLEMENT, No. 176. For tinning, to obtain smooth work, keep the surface of the tin bath clear with a little powdered sal ammoniac and doing the work quickly. If the articles are left in the bath too long, the tin absorbs iron and becomes thick, after which the surface of the tinning will come out rough. Smoothness of finish also depends much upon the smoothness of the pieces to be tinned.

(7) J. B. P.—There is no absolute difference in the heating power of a ton of anthracite coal, whether it be nut or pea, provided the quality is exactly the same in both. The price is the main point in their economical value as fuel. Formerly there was considerable difference in price, so as to largely favor pea coal where the grate was of the proper kind to prevent waste. There is sometimes much culm and dirt in pea coal, which is a cause of waste. This alone makes the nut coal a favorite among engineers. The whole question of economy turns on relative price, cleanliness, and carbon value, so that a decision cannot be arrived at on the simple question.

(8) W. D. A.—Copper lined tanks are often known to give trouble by leaking after a few years, much of which arises from the manner of soldering. Most plumbers use common solder, made of lead and tin. For this kind of work pure tin should be used, and the laps thoroughly sweated through. The nails should be also of copper. We know of no way of repairing for such leaks but to take out the lining and retin all the laps.

(9) J. M. G.—The rich, deep soils of Kansas only need thorough tillage for a few years to repress the weeds. Much of this trouble comes from neighboring untilled land, from which wild seed is blown by the strong winds of that woodless country. Too much land planted without the means for thorough cultivation is probably the cause of much of the trouble from weeds in wet seasons.

(10) R. M. F. (Philadelphia) writes: We have a large room, 60x100x19 feet, to heat by steam; how much pipe would it require, also how large a boiler? A. For your latitude, 2,500 to 2,800 feet 1 inch pipe, according to exposure, with 110 square feet effective heating surface in boiler, or an 8 horse boiler.

(11) F. H. H. asks: Why does not an emery wheel grind as well on the sides as it does on the radius? A. Emery wheels are used on the sides where fine flat surfaces are required. They do not cut as fast because a large surface is in contact with the face of the wheel. The convex surface of the periphery exposes but a small surface in contact at once, requiring but a small pressure to produce a cut.

(12) C. P.—There are so many ways in which engine pumps are affected that no proper solution of your troubles can be arrived at without personal inspection. Sometimes the plan of the valves is defective, so as not to allow of their closing at the proper time, either by the flow of water binding them against their guides or want of vent hole in the cap guide. At other times, air gets into the piston chamber and cushions under the action of the piston, and thereby prevents suction. We can only advise you to get some of your neighboring engineers to hold an inquest over the subject.

(13) T. H. D. S. asks: What do you think of the practice of some engineers and boiler makers of passing the products of combustion from the furnace of a coal-fired return tubular boiler over the top of shell to stack at rear end of boilers, after it has passed under the shell and through the tubes? Is it injurious to boiler? There is a difference of opinion among engineers as to the economy of passing heated gases of combustion back over the boiler. It is in some cases inconvenient for cleaning both boiler and flues. If the flue is neglected, the accumulation of ashes upon the top of the boiler makes the fancied superheating of steam a nullity. It is but little practiced.

(14) E. D. H.—In 1812 Samuel Slater began the erection of cotton mills in Oxford, now Webster, Mass. He had come to this country from England in 1789, when he was 21 years of age, but had then already spent seven years in the cotton mills of Derbyshire, and became familiar with Arkwright's processes. Before going to Webster he operated carding and spinning machinery at Pawtucket, R. I., commencing there in 1790. The machine for making cards was invented by Amos Whittemore, of Cambridge, Mass., and patented in 1797. Previous to 1813, the mills in operation were designed only for spinning, and the twist was sold to weavers. It is said that the first factory in the world conducting all the operations of converting raw cotton into finished cloth was built at Waltham, Mass., in 1813, by Francis C. Lowell, of Boston, this factory having a power loom somewhat improved from the then rather crude model of the British invention.

(15) W. D. O. asks: What is the best composition to remove scales from a boiler? A. Two or three pounds caustic soda dissolved in water and pumped into the boiler, allowing it to remain in the boiler for a day. Next day blow out, at intervals of two hours, one, two, or three cocks as convenient. The second application should be followed by cleaning boiler, if there has been much scale. Extract of tan bark is also used with the soda when it can be had.

(16) W. B. W.—You can use bevel wheels at any angle, as you have sketched.—The largest turbine wheels we know of are "Leffel's" 87 inch, of 1,400 horse power, with 40 feet head, using 21,000 cubic feet of water per minute, making 100 turns per minute; 80 to 90 per cent of the total water power is claimed for these wheels.

(17) W. B. writes: I wish to make an experimental battery for running an incandescent lamp. How many cells of the battery described in the SCIENTIFIC AMERICAN of April 11, 1885, would be required for a 12 candle power lamp? Would a ¾ inch rod do for the zinc plate? A. We cannot advise you to try to run a single incandescent lamp by means of a battery. You will require probably 50 cells of the battery referred to. We think a ¾ inch rod would scarcely give you surface enough.

(18) W. E. asks how celluloid electrotypes are made, and what is the composition. A. Celluloid is composed of vegetable fiber, such as cotton, dissolved in acids. Celluloid printing plates are made by pressing thin plates of celluloid into contact with type dies with heat.

(19) Subscriber asks if the double induction motor run by small water motor (capable of running sewing machine easily) will generate enough current for a small incandescent lamp without any change in present construction of motor. If so, what power lamp. And if change is necessary in the motor, what would it be? A. We think that the motor referred to is so small that when used as a dynamo it would not generate a current sufficient for running a lamp of any kind. 2. Are magnets for magneto bells constructed differently from magnets for common vibrating bells, and if so, which way are they wound (the magneto magnets), and how many layers of what number wire? A. The magneto magnets are permanent magnets. The armatures are generally wound with very fine wire, say 12 or 15 layers of No. 36.

(20) Reader asks whether it is feasible to coat a metal speculum with silver by precipitation. The speculum in question is badly tarnished, so much so that to repolish will destroy the figure. Now, if I can precipitate a silver film over the speculum, all difficulties will vanish. Will the silver act the same on the speculum metal as on a ground glass speculum, and if not, what will be the difference? Am afraid to try, lest I spoil the thing altogether. A. We think there would be no difficulty in coating a clean metal speculum with silver in the manner suggested, but we doubt if you can accomplish it with the badly tarnished speculum which you say you have; would it not be better to send your speculum to some reputable telescope maker, and have him clean it, and, if necessary, correct it?

(21) O. D. W. writes: We have occasion to stain wood with aniline. Is there anything to coat the wood with, or what ingredient could we use to put in the aniline to prevent the wood from fading, so as to keep its color? A. Dissolve your aniline in alcohol, and add to it white shellac varnish, or apply the alcoholic stain directly to the wood, and afterward apply any suitable varnish.

(22) H. K. asks: If a dynamo electric machine as described in SUPPLEMENT, No. 161, be built double the size, will it produce more than double the light, and will it run two 16 candle power incandescent lamps, and will a one horse power engine be sufficient to run it? A. A dynamo twice the size of the one referred to would produce more than double the current, if properly made. It might be arranged to run two 16 candle power incandescent lamps, if wound with wire fine enough to produce a current capable of overcoming the resistance of the lamps. A one horse power engine should run the machine.

(23) K. A. R. asks if cannel coal is more valuable than the soft coal so extensively used throughout the United States. A. We do not understand from your query whether you mean to inquire whether cannel coal is more valuable in a pecuniary sense, or as a fuel. Cannel coal of good quality always brings a very high price, and is therefore of greater value than the ordinary bituminous coal, and it is undoubtedly a more efficient fuel than the ordinary soft coal.

(24) F. W. S.—Electric light carbon is not adapted to use in the Leclanche battery. You should procure carbon plates about 1½ inches wide and ½ inch thick, made expressly for this use. The common method of connecting the wire with the carbon is to cast a lead cap upon the upper part of the carbon rod. The hissing in your battery is probably caused by the decomposition of the battery solution in the contact between the conductor and the carbon. Copper coated carbon rods are not available for batteries of this kind.—Plaster Paris is unfit for the porous cells. —Paraffine may be dissolved in naphtha or benzole.

(25) M. G.—We think your best course to secure an outline for a course in civil engineering would be to write to Cornell University, Ithaca, N. Y., for their prospectus.

(26) J. G. K.—There is no paint with which zinc can be coated to prevent its burning. Its melting point is 773° Fah.

(27) L. J. M. wishes a receipt for burnishing marble paper, such as bookbinders use. A. The paper is first coated with a little size, and the finish produced by friction by means of agate rubbers. Such paper is not made in this country, and cannot be economically manufactured on account of the high price of labor in the United States.

(28) J. W. K. asks: 1. Can you inform me how to make a burglar alarm, also what is the best

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kind of battery to use for such? A. A simple way to make a burglar alarm is to construct a spring key with a rounded knob on the top thereof, and set it in the casing of the window, so that the rounded knob projects beyond the casing when the contact points of the key are separated. A cavity is made in the edge of the sash to receive the rounded knob projecting from the back of the key when the window is closed, so as to permit of the circuit remaining open so long as the window is closed. When the window is raised, the engagement of the sash with the rounded knob will push the key forward, bringing its contact point against the fixed contact. The spring key and its fixed contact lead to a battery and a bell, and when the key makes a contact in the manner described, the bell will be rung. If desirable, the wires may also include a part of an annunciator. The key for a door will be arranged with a pin projecting through the door casing, to be engaged by the door when closed, so that it will push the key forward, away from its fixed contact, thus keeping the circuit open while the door is closed. By this arrangement, when the door is open, the pressure on the pin being released, the key will move forward, and make the contact as in the other case. If desirable, two parallel wires may be run to each window and door in a room, and the spring key will be attached to one of these wires, and the fixed contact to the other wire, so that whenever a key is made to complete the circuit, an alarm will be given. The battery commonly used with the burglar alarm is the Leclanche. The Fuller battery is also an excellent battery for this purpose. 2. Would also like to know how to make a simple interrupter for induction coil. A. You can make a simple interrupter for an induction coil by connecting a coarse file with one of your battery wires, drawing the other battery wire along the face of the file. If you desire to make an electro-magnetic interrupter, you may take a small magnet wound with coarse wire, attach its armature to a flat spring, and place a small auxiliary spring on the back of the armature spring. Support in front of the auxiliary spring an adjustable contact point, connect the contact point with one of your battery wires and the armature spring with the other. 3. How is mercury sold, and how much is it worth? A. The price of mercury is 75 cents per pound. It is usually sold in large quantities in wrought iron flasks containing 100 pounds each.

(29) C. W. M. asks: Do you know of any substance that, if placed between a magnet and a piece of steel, will destroy the attraction of the steel to the magnet? A. No substance having the required property has been discovered.

(30) G. L. F. asks: 1. Can hair be permanently removed by electricity? A. We believe it has been done. 2. How is the operation performed? A. By means of a platinum wire made incandescent by the passage of electricity. The wire is thrust down by the side of the root of the hair. 3. Is it painful? A. We believe it is not extremely painful.

(31) L. W. B. writes: 1. I have seen it stated that the rifles used by the sharpshooters in the late civil war weighed as much as a hundred pounds; now, is this so, and where can I learn their construction, etc.? A. They were of various weights, but, we believe, none of them weighed one hundred pounds. There is a good article on rifles in Appleton's Cyclopedia. 2. In filling the lining of a fireproof safe with plaster of Paris, will it make any difference whether it is put in dry, or mixed with water and poured in? A. It should be put in dry. 3. Where can I find out all about archery? A. You can find out much about it in works on the subject, which are sold at the principal book stores.

(32) W. C. C. writes: We have constructed a number of carbon batteries in which we used red flower-pot clay for our porous cups, the batteries being excited by electropoion fluid. For a short time they seem to give considerable current, gradually decreasing in quantity. The fluid turns a dark green color, and gives off sulphureted hydrogen gas; at the same time, purple crystals form inside the porous cups. The batteries have been charged as directed; the carbons placed in the porous cups and filled with electropoion fluid, and the zincs in the outer jar, which is filled with water. A. The green color of the solution indicates that your battery is exhausted, and the generation of hydrogen shows that your zinc is not perfectly amalgamated. The zinc should be amalgamated thoroughly, and the fluid should be changed when exhausted. Possibly your jars are too porous. Try filling a portion of the walls of the jars with paraffine. To accomplish this, you will need to have the jars clean, dry, and hot.

(33) J. D. asks: 1. What will remove from paper the impression in red ink of a rubber stamp? I have tried an ink eraser of two liquids, being, I am told, the first, dilute acetic acid, and the second lime water, but it leaves the impression in pale brown. A. Remove the oily material of the ink with ether or naphtha, then try a bleaching powder. 2. What would be the cost of maintaining an ordinary Edison incandescent lamp by chemical battery? A. We are unable to give the exact figures, but the cost to run a single lamp is much more than that of gas. 3. How many cells, and what kind, would be best, cleanest, and most convenient for a private dwelling? A. This depends of course upon the number of lamps you use, their resistance, and the manner in which they are connected up in the circuit. Probably the bichromate form of Bunsen battery is the best. They work fairly well for one week without renewal.

(34) J. D. C. asks: 1. Does a body passing through air create friction? A. Yes. 2. Is there friction in air? A. Yes.

(35) C. S. B. writes: 1. In the dynamo described in SUPPLEMENT, No. 161, if, instead of the outside of the field magnets being made straight at the lower end, they are made bracket-shape, or provided with outwardly projecting flanges, will the magnetism collect at the flanges instead of where it is needed? A. The magnetism would be liable to be dissipated by the lateral extension of the poles. 2. Which gives the more sound for the same weight of metal—a bell or a gong? A. For the same weight of metal, the gong will give the louder sound.

(36) Miss A. C. asks: 1. What kind of coal produces gaslight? A. Bituminous. 2. How is gas secured? Is it by propelling it into a gasometer, or by what process? A. Gas is made by distilling bituminous coal in a closed retort, conducting the gaseous products through a washing and purifying machine to a gasometer. It is forced through the main and service pipes by the pressure of the gasometer. Coal gas, when very poor in carbon, is sometimes carbureted by the employment of gasoline or naphtha. 3. Does any other matter mix in with the gas while securing it? A. See answer to No. 2. 4. When in general gasometer, how is gas propelled into the houses? Since the gasometer is filled, how can the gas be prevented from receding? A. The gas is prevented from receding by valves or water traps. The pressure created in the retorts is sufficient to carry the gas into the gasometer against the pressure of the gas contained by the gasometer; but in most gas works a machine called a gas exhauster is employed to take the gas from the retorts, and force it into the gasometer. 5. And is there any danger of explosion from overpressure of gas? A. There is no danger of explosion from overpressure of gas, as the pressure is very slight—the greatest pressure being equal to a column of water 1 to 2 inches high. Gas when mixed with air forms an explosive compound, which is sufficiently powerful, when ignited, to destroy the gasometer. 6. Has the gasometer any compartments? A. Generally, gasometers have no compartments. They are sometimes, however, made in two sections arranged telescopically, so as to increase the capacity of the gasometer without making the water reservoir too deep.

(37) W. A. D.—We think the statement of the experiment of causing an iron beam to swing to and fro by hitting it with pith balls is a little fanciful. No doubt the iron beam could be set into vibration by means of the cork pellets, if thrown at regular intervals, and synchronously with the vibrations of the bar; but we do not think that any tremendous results would be secured by bombarding an iron beam with pith pellets.

(38) G. A. H. writes: I have a clinical thermometer which from frequent use has become almost illegible, from the wearing off of the black markings of the scale. Will you please give me a recipe for a permanent preparation by which I can mark it again? A. Probably the marks on your thermometer are engraved, and the black filling has been removed. You can refill the engraving marks by rubbing the scale over with asphaltum varnish, leaving the varnish only in the engraved marks. The surplus on the surface of the scale may be removed by a cloth wet with a little turpentine.

(39) R. L. N. asks what the red substance is that dentists use for plates for artificial teeth, and how it is worked. Will you also state what book will give me some information on dentistry? A. The substance referred to is rubber colored with vermilion. Previous to vulcanizing, it is very plastic, and may be forced into warm moulds. For dental work the moulds are generally made of plaster of Paris. After the mould is filled and secured, it is placed in a vulcanizer, which is simply a small steam boiler, and is allowed to remain in the vulcanizer under a steam pressure of 100 pounds, or a temperature of 320°, for one hour.—You can procure books on Dentistry from any of the dental depots in this city or in Philadelphia.

(40) B. A. L. asks: Can you give me a receipt for a lacquer or varnish for varnishing an old theodolite? Would one of shellac varnish colored with lampblack be suitable? Would it stand wear any length of time? A. You can color the brass parts of your instrument black, by dipping them in a solution consisting of sulphate of copper ¼ ounce, hyposulphite of soda ⅛ ounce, dissolved in one pint of water. Clean the articles thoroughly, and heat them in the solution. More hyposulphite of soda renders the articles darker, and the addition of more sulphate of copper renders the color gray. Another method of giving brass articles a dark color is to dip them in a solution of arsenic and muriatic acid. These articles, after being colored, may be protected by a very thin coat of shellac varnish or lacquer. Either of the above stains for brass wears well.

(41) W. T. P. writes: I wish to construct a pair of cylinders to condense oxygen and hydrogen gases for lime light use. What thickness should one 16 inches in diameter and 48 inches long be made of, either steel, iron, or copper, to hold a pressure of 250 pounds per square inch? A. Your cylinders should be made of three-sixteenths steel riveted and brazed. We think you have selected a size larger than is necessary for ordinary use. If you make your cylinders 12 inches in diameter, and 3 feet high, they will contain about 2·4 feet of gas each. Your cylinders, if made of the dimensions given, have a capacity of 5·58 cubic feet each. 2. How many cubic feet of gas would such cylinder hold at above pressure? A. At 250 pounds pressure, each cylinder will contain about 90 cubic feet of gas. 3. Please give a rule to find the pressure for each doubling of the cylinder's capacity. A. When you have created a pressure in your cylinder of 15 pounds, it will contain 5·58 feet of gas; when you have doubled the pressure, it will contain 11·16 feet. When you have increased the pressure to 60 pounds, it will contain 22·32 feet, and so on.

(42) P. S. K. W. asks what to use to make a thin coating on wood so that hot oil will not penetrate it. A. Use an alcoholic solution of gum shellac.

(43) A. R. asks how to obtain instruction book on mechanical drawing. A. Probably in no other work is there so much furnished for the price as in Professor MacCord's papers, published in the SUPPLEMENT. We have these papers, containing 450 special engravings, stitched in paper, for $2.50, or bound in cloth for $3.50.

(44) J. K. M. S. desires a receipt for some liquid which, if applied in small quantities, will kill a tree. A. Use kerosene or turpentine around the roots.

(45) R. V. G. asks: 1. Are there any lead pencils made so that the marks will not rub off if you varnish them over? A. Ordinary pencil marks can be preserved by coating them over with a solution of collodion to which 2 per cent of stearine has been added. 2. Have you any book treating on the subject of acids? A. Fownes' Chemistry, which is an excellent authority, we can send you for $3.50. 3. A recipe for putting metal leaf on wood. A. Coat the wood with a size made as follows: To ½ pound parchment cuttings or cuttings of white leather add 3 quarts water, and boil it in a proper vessel till reduced to nearly half the quantity; then strain through a sieve.

(46) E. A. B. desires the receipt of a good glue for pasting labels on the backs of library books. A. Strong glue, 50 parts, is dissolved with a little turpentine in a sufficiency of water over a gentle fire; to the mixture is added a thick paste made with 100 parts of starch. It is applied cold, and dries rapidly.

(47) L. N. T. asks: What preparation is used to gild the edges of writing paper, and how is it applied? A. A camel's hair pencil is dipped into white of egg mixed with water, and with this the dry edges of the paper are moistened; gold leaf is then taken up on a tip brush, and applied to the moistened edge, to which it instantly adheres. When all three edges have been gilded in this way, and allowed to remain a very few minutes, take a burnisher formed of a very smooth piece of hard stone, and rub the gold very forcibly, which gives a high degree of polish.

(48) K. H. H. desires a receipt for a freezing mixture—one that will freeze or bring water as near the freezing point as possible, and be capable of being re-used several times, so as to render its cost as inexpensive as possible compared to the practical results to be attained therefrom. A. Use:

Nitrate of ammonia.....1 part.
Water .....1 "

The mixture should be made in a thick vessel, well clothed, to prevent the accession of external heat; and the substances to be acted on should be contained in a very thin vessel, so as to expose it more fully to the action of the mixture. See also Freezing Mixtures, in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 89, 252.

(49) S. R. B., Jr., desires a recipe for polishing horns. A. First scrape with glass to take off any roughness, then grind some pumicestone to powder, and, with a piece of cloth wetted and dipped in the powder, rub them until a smooth surface is obtained. Next polish with rottenstone and linseed oil, and finish with dry flour and a piece of clean linen rag. The more rubbing with the stone and oil, the better the polish. Trent sand is used in the Sheffield factories. It is a very fine and sharp sand, and is prepared for use by calcining and sifting.

(50) H. W. O. writes: 1. I wish to mix graphite and pulverized asbestos with lead. Is there anything that I can add to make them adhere when the lead is heated to a low state of fusion? A. Nothing but a mechanical mixture of these three ingredients can be made. 2. I would like to granulate the lead at low heat without hardening it. Antimony and tin both make it hard, and for this reason cannot be used for the purpose required. A. The addition of bismuth, tin, and cadmium will lower the fusing point of lead.

(51) G. H. desires (1) a recipe to bleach fish scales. A. The application of hydrogen peroxide (see SCIENTIFIC AMERICAN SUPPLEMENT, No. 339) would bleach the scales, provided that fat and oily matter was first removed by washing with alkalies. 2. What is magic compound to clean carpets? A. Carpets are frequently cleaned by the following process: Take a pailful of clean cold spring water, and put into it about 3 gills of ox gall. Take another pail of clean cold water only. Then rub the carpet with some of the ox gall water, using a scrubbing brush, which will raise a lather. When a convenient sized portion is done, wash the lather off clean with a rag or cloth dipped in pure water. When all the lather has disappeared, rub the part with a clean dry cloth. The magic compound probably consists of a concentrated solution of ox gall.

(52) M. C. B. asks (1) what the process is for extracting the oil from the Palmi Christi bean? A. The beans are heated in an iron tank and then pressed. 2. Whether the cake or residue is of any value after the oil is expressed? A. The cake is frequently used as feed and for a fertilizer. 3. Are there any manufactories in the United States? If not, where are they located? A. St. Louis is the center of the castor oil industry in this country. Information as to the cultivation of the bean is given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 186, under title of "The Castor Bean Plant."

(53) J. A. T. asks: What will remove or prevent the collection of coating in hot beer pipes commonly called beerstone? A. The pipes may be cleaned by washing out with a strong hot solution of soda.

(54) R. E. M. asks a receipt for preserving the juice of lemons for six months or longer. A. Add a small quantity of benzoic acid or salicylic acid. Either of these agents will prevent decomposition.

(55) A. I. asks for a paint that will resist the action of a strong solution of sulphuric acid, and where it can be purchased. A. A coating of liquid asphalt, made by melting asphaltum, will resist the action of sulphuric acid. This substance can be procured from dealers in tar and like materials in your city.

(56) W. H. S. writes: I have some valuable papers from which ink stains were taken by means of acids, but by so doing ruined the finish or enamel. How can I reglaze it? A. The sizing of paper consists of a mixture of glue and alum water. For your purpose a little gum arabic dissolved in water and passed over the erased surface is perhaps as good a remedy as you can easily try.

(57) J. A. H. asks for a varnish or coating that may be used to prevent wood from absorbing moisture in refrigerators. A. Use shellac varnish prepared by dissolving white shellac in alcohol. 2. A recipe for a varnish of a light shade, that will bear washing off with water, to be used on muslin or linen, and be rolled and unrolled often without cracking? A. The addition of a small amount of glycerine to the foregoing can be used for the purpose mentioned, but it is not very satisfactory. The waterproof flexible varnish is generally prepared by dissolving 1½ ounces pure India rubber in 1 pint of chloroform, ether, or carbon disulphide.

(58) E. C. M. gives the following description of a simple open circuit battery devised by him: Take an ordinary fruit jar and place in it a number of pieces of broken electric light carbons, hundreds of which can be picked up in the street after the lamps have been trimmed. One of the bottom pieces is securely bound with one end of a gutta percha covered wire, which, going up to the top, makes the connection with binding screw on cover, the cover being made of wood or hard rubber. Next an ordinary Leclanche battery zinc is suspended from the cover of the jar, reaching down to within an inch or two of the carbons. The exciting fluid is a solution of sal ammoniac and water. E. C. M. says he now uses this battery in connection with a burglar alarm which works very satisfactorily. [We presume uncoppered carbons are used in this battery, as sal ammoniac would attack the copper, and the solution would be weakened.]

(59) J. H. L. asks: If a rocket was fired in a vacuum, would it rise or remain stationary? The rocket is supposed to be an ordinary practicable rocket, and the vacuum an infinite theoretical vacuum. A. It would remain stationary.

(60) J. N. B. writes: Some time ago some one asked for a simple method of filling barometer tubes so as to get the bubbles out, without boiling the mercury. For ordinary weather glasses, I have had fair success as follows: Place a little tuft of raw cotton (clean and fine) in the bottom (*i. e.*, top when filled) of the tube, to which is tied a small thread; then fill the tube as full as possible, and pull the tuft of cotton out slowly. All air bubbles in the mercury will condense into the cotton, and a clean solid tube will appear. After the cotton is out, fill up to overflowing, press a small piece of thick leather over the end, and invert into a cup of mercury, etc.

(61) W. G. T. writes: Will you please inform me if at any time the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT has given directions for the construction of an electric motor of about one-half horse power or over? If so, please inform me when it was issued. A. You will find descriptions of electric motors in SUPPLEMENT, Nos. 323, 212, 267, and 259. The dynamo electric machine described in SUPPLEMENT, No. 160, will answer for a motor, if you wind the armature with No. 16 instead of No. 18 wire, and wind the magnet with No. 14 wire, employing only about four layers.

(62) W. H. B. says: Will you please tell the cause of the following: In one corner of our cellar the concrete floor has been thrown up, just as though there had been an eruption under the floor. The floor is 4 inches thick, and we cannot find out why it has acted so. A. This may be caused by the upward pressure of water in the ground or by the lateral expansion of the concrete. Even if water is not shown, the air under the pavement may be subjected to a great pressure by the increased amount of water below it, the height of the latter being constantly changed by wet or dry states of the weather.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

B. E. N.—No. 1 is magnetic iron sand, and may be valuable as an iron ore. An analysis, costing $15.00, would be necessary to determine this. 2. The red particles may be fragments of garnets or colored quartz. The sample is sand containing iron.

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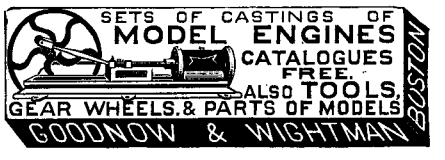

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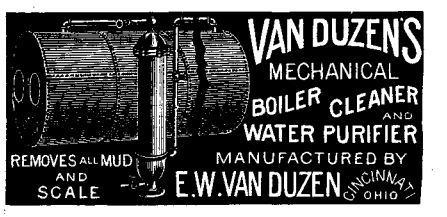

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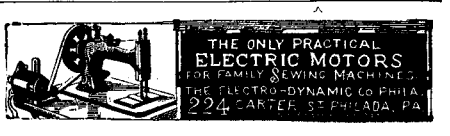

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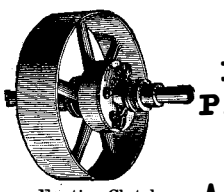

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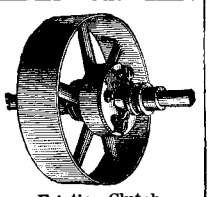

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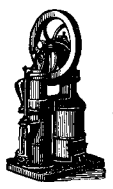

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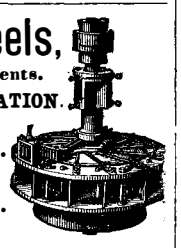

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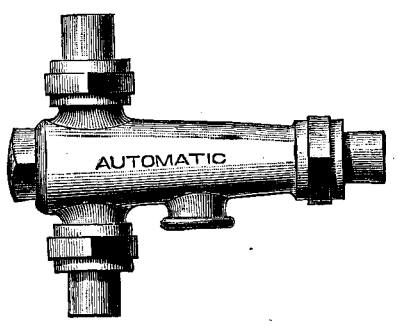

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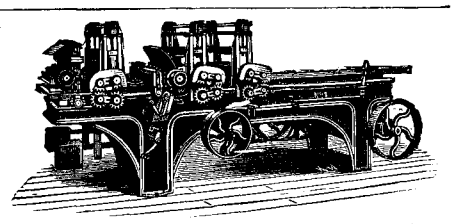

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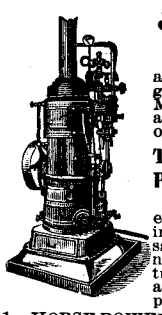

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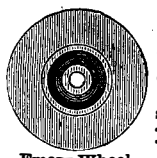

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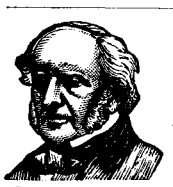

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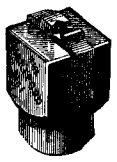

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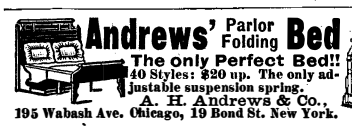

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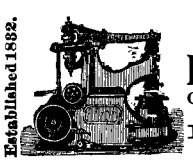

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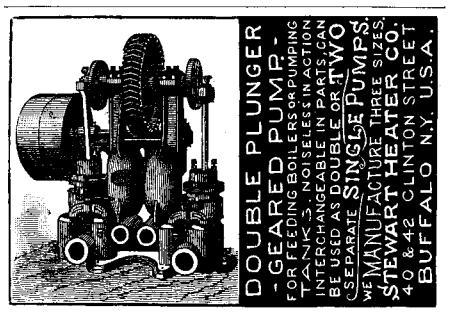
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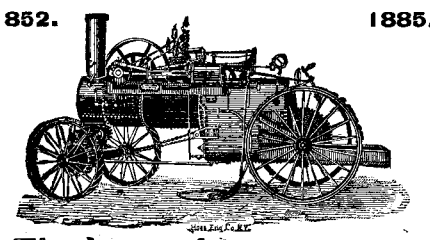

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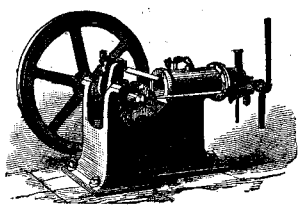

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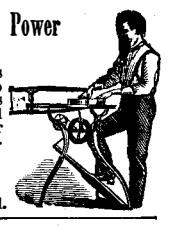

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